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OLDMAN RIVER DAM WILDLIFE INVESTIGATIONS -
SPRING AND SUMMER, 1985

ENVIRONMENTAL MANAGEMENT ASSOCIATES
and
SALIX ENTERPRISES LTD.

OLDMAN RIVER DAM
WILDLIFE INVESTIGATIONS -
SPRING AND SUMMER, 1985

Prepared for
ALBERTA ENVIRONMENT, PLANNING DIVISION
Edmonton, Alberta

Prepared by
D.A. YOUNG, D.A. WEIDL, L.M. ALLISON AND H.J. RUSSELL
ENVIRONMENTAL MANAGEMENT ASSOCIATES
Calgary, Alberta
and
SALIX ENTERPRISES LTD.
Cowley, Alberta

MARCH, 1986

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EXECUTIVE SUMMARY

The Planning Division of Alberta Environment commissioned wildlife studies in 1985 as one component of environmental investigations relating to the proposed Oldman River dam. Environmental Management Associates and a subcontractor, Salix Enterprises Ltd. were retained to undertake these wildlife studies during a period that spanned the months of June through September.

The general objective of the studies was to evaluate the extent to which resident and/or breeding populations of the following species or groups utilize the area potentially affected by construction of the Oldman River dam: deer, badger, long-tailed weasel, Canada Goose, Merlin, Peregrine Falcon, Prairie Falcon, Ferruginous Hawk, Burrowing Owl, northern leopard frog and western painted turtle. An eleventh species, the yellow-bellied marmot was added to the list once it became apparent that this species inhabited the Study Area. Use of the proposed reservoir area by ducks was also examined. The principal, specific objectives of the study included:

- ° Inventory the wildlife of the reservoir area and correlate this utilization with key habitat requirements;
- ° based on the above, determine, at a preliminary level, the impact upon each species or group.

The 1985 investigations revealed that the proposed reservoir area constitutes an important summering area for approximately 200 mule deer and 10-15 white-tailed deer. The extent to which surrounding areas would be capable of sustaining these displaced animals is unknown. Two colonies of yellow-bellied marmots were discovered on the Castle River, both of which would be inundated by the proposed reservoir. The extent to which these animals will be successful in colonizing new locations will depend upon the availability of suitable habitat in the form of boulder piles. Badgers and long-tailed weasels have been observed in the reservoir area but were not encountered during the course of 1985 field studies. Badgers typically

inhabit grassland areas above the reservoir area and even if some animals were displaced, numbers would be low and considerable alternative habitat would be available. Long-tailed weasels are highly adaptable in terms of habitat utilization. Weasels have historically inhabited the area but in apparently small numbers and sufficient, suitable alternative habitat is widely available.

Canada Geese nest in low densities (five pairs) on river islands, shorelines and cliffs within the proposed reservoir area. This species is one of the most adaptable in terms of selection of nest sites and as a result, areas upstream or downstream of the reservoir and shorelines of the reservoir itself will provide suitable nesting habitat. Ducks also frequent the Study Area, with Mallards and Common Mergansers accounting for most of the birds observed. A lack of suitable habitat in the form of slow-flowing or standing water is the chief factor responsible for the poor utilization of the Study Area by ducks. Areas downstream and upstream of the proposed reservoir will be capable of sustaining any displaced birds and the reservoir itself may provide some suitable breeding and staging habitat.

Ferruginous Hawks nested within the proposed reservoir area (one nest) as well as along shorelines of the Oldman River, upstream and downstream of the reservoir. This species nests in trees or on cliffs but the presence of grasslands in close proximity to nests is probably the most important factor in nest-site selection as these birds feed largely on ground squirrels from such areas. Trees and cliff faces for nest sites and broad tracts of grassland are abundant adjacent to the proposed reservoir, with the result that numerous alternative locations would be available for the single, displaced nesting pair. Three Merlins were observed but no evidence of nesting activity was discovered. This species nests in wooded areas and habitat of this nature is widely available both above the reservoir F.S.L. and upstream or downstream of the reservoir. No Peregrine Falcons were observed and this species has not nested in the reservoir area for many years. The Prairie Falcon represented the most commonly observed key bird species within the proposed reservoir area. Four nest sites occu-

pled in 1985 would be inundated by the proposed reservoir. Some unoccupied nesting habitat is present above the reservoir F.S.L. and upstream or downstream of the reservoir itself. Nonetheless, five other pairs of Prairie Falcons occupy nest sites immediately adjacent to the proposed reservoir and the unoccupied, alternative habitat may or may not be capable of supporting birds displaced by the reservoir.

Although local residents have observed Burrowing Owls, no birds were observed during the 1985 investigations. Given the association between Burrowing Owls and burrowing mammals in grassland areas, it is likely that Burrowing Owls would be encountered above, rather than within the river valleys where inundation would occur.

The lack of standing water is the chief factor responsible for the absence of northern leopard frogs within the proposed reservoir area. Similarly, the paucity of slow-flowing or standing water dictates that the occurrence of western painted turtles would be highly unlikely in the proposed reservoir area.

1.0 INTRODUCTION

The Government of Alberta is planning to construct a dam on the Oldman River, downstream of the confluence with the Castle River and Crowsnest River. The Planning Division of Alberta Environment is assembling an Environmental Mitigation/Opportunities Plan for the project, of which ecological issues form one component of this Plan. Within this ecological component, the topic of wildlife merits consideration and to this end, studies were commissioned by the Planning Division.

The proposed reservoir is located within an area believed to be occupied by a broad diversity of wildlife. Nonetheless, the status of those populations is poorly understood. A review of existing information (Westworth 1985) revealed certain information deficiencies in the data base. Field studies were thus commissioned by Planning Division to rectify those data deficiencies. Environmental Management Associates (EMA) and a subcontractor, Salix Enterprises Ltd. (Salix) conducted these studies during spring and summer, 1985 to assist in the assessment of reservoir-related impacts on the wildlife resource. EMA was responsible for all wildlife species or groups except for ungulates which were addressed by Salix.

2.0 OBJECTIVES

The general objective of the study was to evaluate the extent to which resident and/or breeding populations of important, rare or endangered mammals, birds, amphibians and reptiles utilize the area potentially affected by construction of the Oldman River dam. The actual terms of reference (dated 14 May, 1985) are presented in Appendix I. The study's intent was to focus on nine key species: badger, long-tailed weasel, Merlin, Peregrine Falcon, Prairie Falcon, Ferruginous Hawk, Burrowing Owl, northern leopard frog and western painted turtle. The original terms of reference were expanded to address ungulates and any other species or groups that might merit consideration.

Specific objectives of the study were:

- inventory the wildlife of the reservoir area and correlate this utilization with key habitat requirements;
- based on the above, determine the impact upon each species or group;
- evaluate the magnitude of Canada Goose nesting and brood-rearing within the proposed reservoir and in adjacent areas upstream and downstream of the reservoir;
- evaluate the extent to which ungulates frequent the reservoir area during late spring and summer;
- interview local landowners to assist in the assembly of historical and current information for wildlife of the reservoir area;
- map the distribution of wildlife and relate that distribution to habitat utilization.

3.0 METHODS

3.1 INTRODUCTION

Information was derived from a review of pertinent literature, consultation with resource agency personnel and local landowners, and field studies.

3.2 LANDOWNER INTERVIEWS

A letter describing the intent of the summer wildlife studies was sent to 77 landowners in the vicinity of the proposed reservoir in June, 1985. The cooperation of the landowners was sought in assembling information on the distribution of the key species under investigation. Landowners were subsequently contacted by telephone and 17 of these were interviewed.

3.3 AERIAL SURVEY

An aerial survey by helicopter was conducted of approximately 106 km of river valley on 5 June, 1985. The surveyed area consisted of the proposed reservoir area plus three, four-km long buffer areas, upstream of the proposed impoundment areas of the Oldman, Crowsnest and Castle rivers (Figure 1). In addition, the Oldman River and its valley walls were surveyed between the proposed dam site and the L.N.I.D. weir (Figure 1).

The survey from a Bell 206B helicopter was conducted at varying altitudes above ground level (a.g.l.) and at airspeeds ranging from 30-70 km/h. The flight path and altitude was also adjusted during the surveys to minimize disturbance to residences and livestock. The basic flight (survey) pattern involved flying the aircraft at an approximate horizontal distance of 100 m from the valley walls, with the aircraft at an altitude which allowed the observers on that side to examine potential cliff-nesting

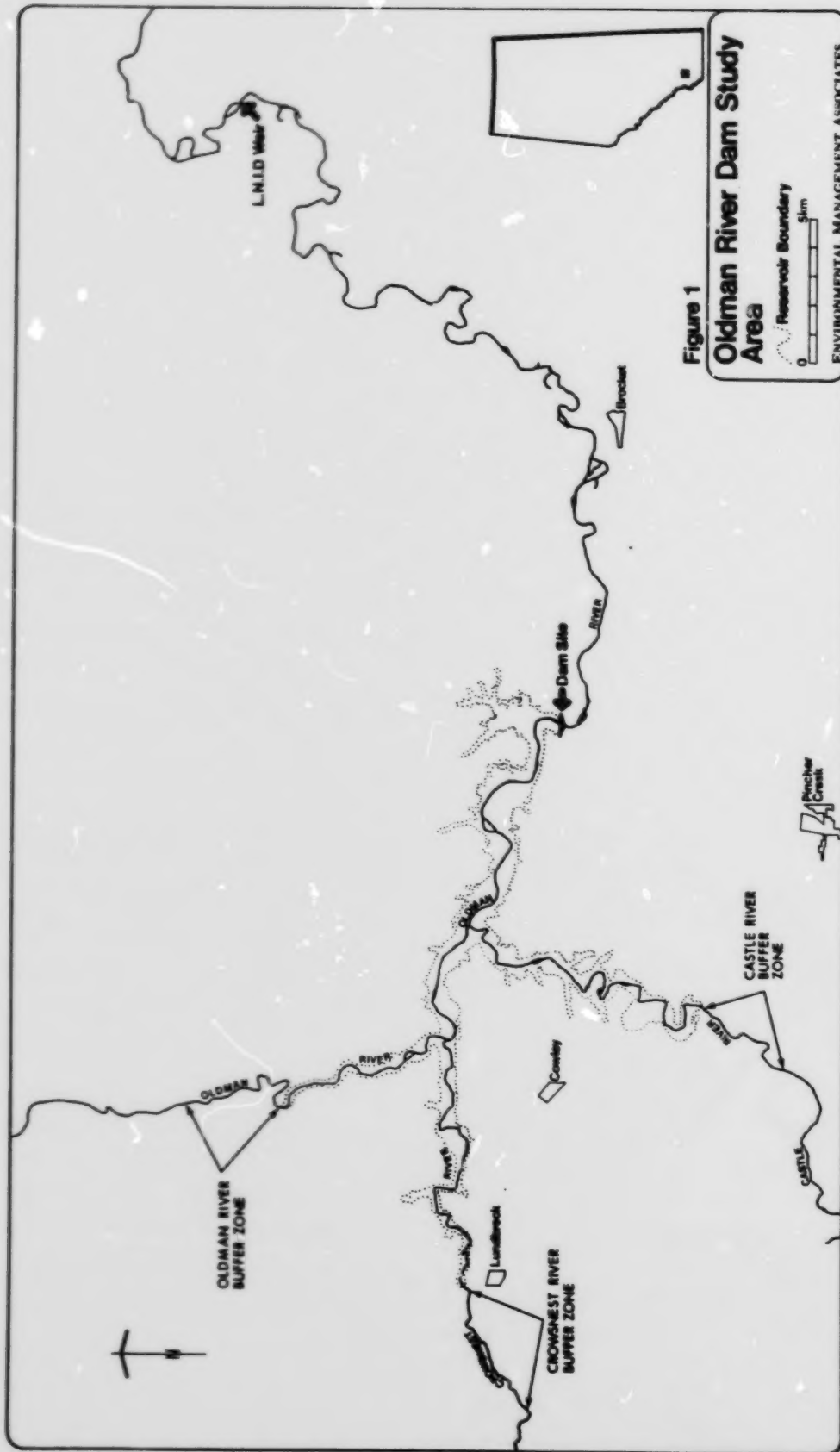


Figure 1

Oldman River Dam Study Area

ENVIRONMENTAL MANAGEMENT ASSOCIATES

habitat and trees for the presence of nests and/or birds. Observers on the opposite side of the helicopter surveyed the river shoreline and the river itself for shoreline nests and waterfowl. For smaller valleys, the aircraft was flown down the centre of the valley, allowing observers on both sides of the helicopter to view the valley walls on their side of the aircraft. When a raptor nest, a potential nest site or other wildlife were encountered, the helicopter was briefly hovered, where necessary, to confirm that observation. At locations where animals were present, the hovering time was kept to an absolute minimum (maximum of three seconds) to reduce the potential for disturbing that species. Confirmation of nesting activity was undertaken during boat and ground-based surveys. Notes were also made on the distribution of grasslands within the proposed reservoir which could provide potential habitat for Burrowing Owls and badgers. These areas were subsequently examined by ground crews.

The seating arrangements in the helicopter consisted of three biologists in the left front, left rear and right rear seats of the bubble window-equipped aircraft. Observations were made by all three biologists and the pilot who were all in verbal contact throughout the surveys. In addition to observing, the left front seat observer navigated, plotted observations on 1:50 000 scale NTS topographic maps and dictated information into a hand-held tape recorder.

3.4 BOAT-BASED SURVEYS

Boat-based surveys of the Study Area were conducted to:

- ° confirm the status of raptor nests.
- ° detect the presence of Merlins, and other raptors and their nests not observed during the aerial survey.
- ° enumerate waterfowl and their broods.

- ° search for goose nests.
- ° survey for western painted turtles and northern leopard frogs.

Two separate boat-based surveys were conducted. The first occurred from 6-8 June, 1985 and was conducted from an inflatable boat (Zodiac) while water levels were high. The second survey, from 16-17 July was conducted from a canoe due to its increased manoeuvrability during lower water conditions.

One of the principal objectives of the June survey was to determine the presence of nesting Prairie Falcons and describe the utilized and potential nesting habitat for this species. The nest sites were not visited to ascertain their status until the July boat-survey, as eggs would definitely be hatched by then and adults were less likely to desert the nest at this time.

Areas of densely treed habitat along the river were searched for tree-nesting raptors. When adult raptors or nests were encountered, these locations were examined by spotting scope and on foot to determine whether nests were occupied.

The June survey also concentrated on searching islands for goose nests. The two biologists traversed the perimeter of each island on foot. The areal extent of the islands searched is presented in Table 1. As Canada Geese are also known to nest on cliff faces, these areas were also scanned while floating downstream. Other waterfowl and nests observed during these surveys were also recorded. Due to the number of islands and other tasks undertaken during the June float trip, any islands not surveyed in June were surveyed during the July float trip. During the course of the investigations, unused but suitable potential nesting habitat was delineated, particularly in "buffer zones" adjacent to the proposed reservoir.

The fourth major objective of the float trip was to enumerate waterfowl, particularly Canada Goose broods. Brood surveys were conducted

TABLE 1

AREAS AND LOCATIONS OF NEST SEARCHES OF ISLANDS
DURING BOAT-BASED SURVEYS OF THE STUDY AREA, SUMMER, 1985

Location	Island Size (ha)	Length of River Travelled (km)
Crowsnest River	0.15 0.25 0.15 0.37 0.37	
TOTAL	1.29	11.5
Upper Oldman River	0.22 3.50	
Oldman River from Cowley Bridge to Damsite	0.90 11.00 0.75 0.60	
TOTAL	16.97	22.0
Castle River	1.50 0.37	
TOTAL	1.87	14.0
TOTAL HABITAT SEARCHED WITHIN PROPOSED RESERVOIR	20.13	47.5
Oldman River below Damsite to Summerview Bridge	7.50	
Oldman River below Summerview Bridge to L.N.I.D. Weir	1.50 0.75 0.25	
TOTAL HABITAT SEARCHED DOWNSTREAM OF DAMSITE TO L.N.I.D. Weir	10.0	41.5

in June to determine the numbers of broods before creching (mixing of broods) occurred. During the July trip information was collected on utilization of the Study Area by duck broods which hatch later than goose broods.

All duck and goose broods were aged using plumage characteristics (Gollop and Marshall 1954). This approach avoided "double-counting" broods which were first observed in June and which were again present during the July survey. Furthermore this allowed for the incorporation of broods which hatched subsequent to the early June survey into the total number of broods.

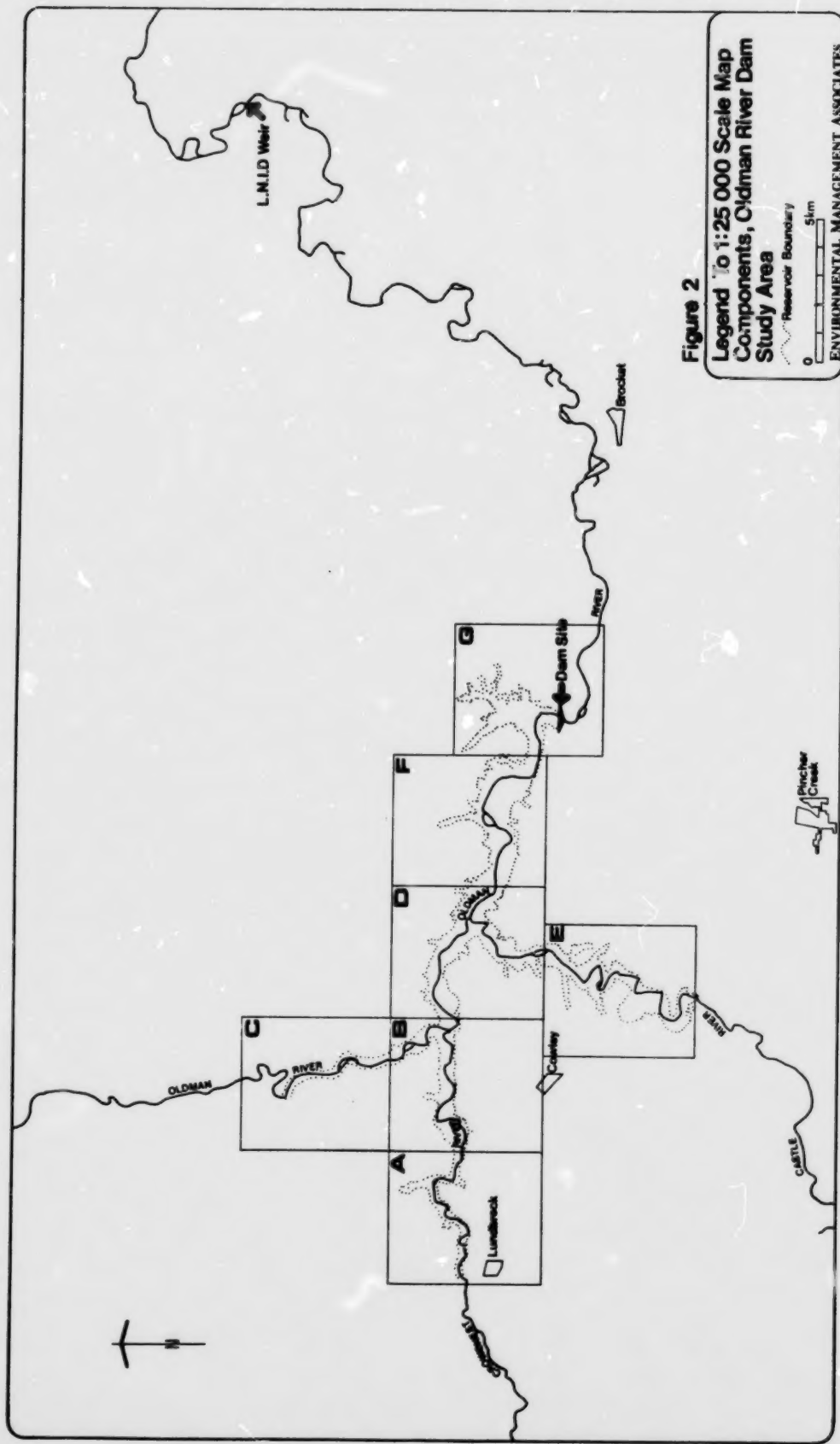
The July survey also facilitated searches for western painted turtles and northern leopard frogs. These species were more likely to be seen basking in the sun in mid-July than during the early June survey.

Photographs of used and potential nest sites were taken during both the June and July float trips and video tapes were used to record some wildlife observations and habitat during the July trip. Information was also plotted on a 1:25 000 scale photomosaic which was divided into the sub-sections illustrated in Figure 2.

3.5 GROUND-BASED SURVEYS AND INTERVIEWS

3.5.1 Key Species

The ground-based surveys were carried out to further examine tracts of land between the floodplain and the crest of the river valleys which were not visible during the boat-based surveys. Groves of trees were examined for nesting Merlins and Ferruginous Hawks. Tracts of land delineated during the aerial survey as being potential habitat for badgers and Burrowing Owls (i.e., grasslands) were also examined. The search for Burrowing Owls and Merlins was concentrated during the July survey when owl broods would have emerged from their dens and Merlins would be more vocal around the nest site.



To maximize the area surveyed using this technique, the biologists worked independently on foot. Binoculars and spotting scopes were used to survey open tracts of land for badger dens or Burrowing Owls. Surveys were conducted from 11 through 13 June and from 10 through 13 July, 1985. Surveys were conducted during the first four hours after sunrise and three hours prior to sunset.

It should be noted that where applicable, landowner's permission was obtained to walk on or drive to areas that were surveyed during this time. Casual interviews with landowners were undertaken on these occasions to obtain information concerning the key wildlife species as well as other wildlife sightings.

3.5.2 Deer

By late spring, mule deer and white-tailed deer have dispersed from their wintering concentrations into summer habitat. Because of the dispersed nature of the population, the secretive habits of does subsequent to fawning, and the use by deer of habitat obscured by leaves, it was considered unrealistic to attempt a complete count of the deer using the reservoir area in summer. It was, however, possible to obtain a general impression of the magnitude of deer utilization of the Study Area plus an assessment of habitat preferred at this time of year.

The portion of the study that focussed specifically on deer was addressed through foot-based surveys by personnel of Salix Enterprises Ltd. Data from these surveys were supplemented by observations from EMA staff conducting other wildlife investigations in the Study Area. The Salix field work was begun after most of the EMA field work was complete. The EMA field surveys commenced on 5 June and were completed on 13 July. Salix field work began 12 July and ended 3 September, just prior to the formation of fall groupings of deer.

Locations of all observations, including incidental observations of species of wildlife other than deer, were plotted on field maps at a

scale of 1:50 000, and subsequently transferred to an overlay of the 1:25 000 vegetation photomosaic.

Foot-based surveys for deer commenced at first light: 0500 to 0600 h depending on the date and the weather conditions. They ended before the day became too warm, when deer were less-readily visible (about 11:00 to 12:00 h).

Notes on locations, habitat type and other features were made when deer were sighted. Habitat types were read from the vegetation photomosaic (Reid et al. 1985) where appropriate but in cases of disagreement between the field notes and the designated vegetation type on the photomosaic, the field notes were used for classifying deer observations. The areal extent of the vegetation types described by Reid et al. (1985) is presented in Table 2 and a detailed description of those vegetation types is presented in Appendix II.

TABLE 2
AREAS OF THE VEGETATION TYPES IN THE OLDMAN RIVER STUDY AREA¹

Vegetation Type	Reservoir Area		Peripheral Area Between Reservoir and Study Area Boundary	
	Area (ha)	Approximate % of Total Reservoir Area	Area (ha)	Approximate % Peripheral Area
1A Western wheat grass - June grass	1 435.3	57.3	4 259.7	46.2
1B Rough fescue - oat grass	45.7	1.8	36.9	0.4
2A Saskatoon - choke cherry	75.9	3.0	129.5	1.4
2B Skunk bush - creeping Juniper	96.3	3.8	47.4	0.5
3 Cottonwoods	367.5	14.7	0	0
4 Aspen	10.2	0.4	35.3	0.4
5 Limber pine	0	0	4.9	0.1
6 Douglas fir	61.2	2.4	62.0	0.7
C Cultivated	408.4	16.3	4 607.3	49.9
GP Gravel pit	6.2	0.3	10.2	0.1
Town of Lundbreck	0	0	27.3	0.3
TOTAL	2 506.8	100.0	9 220.4	100.0

¹ Source - Reid et al. (1985)

4.0 RESULTS AND DISCUSSION

4.1 YELLOW-BELLIED MARMOT

4.1.1 Population Status

The yellow-bellied marmot is reported as rare in Waterton Lakes National Parks and occurs there only on a casual basis (Soper 1973). The species was first recorded in southern Alberta based on a specimen collected during the summer of 1951 in a rocky coulee of the Milk River valley, north of the Sweet Grass Hills. Soper (1964) also refers to an extraordinary record of a male collected near Lake Newell, near Brooks, Alberta in 1957.

This species has evidently been expanding its range eastwards, as two colonies were discovered during this study within the proposed reservoir area on the Castle River (Figure 3D and E in Appendix III, Table 3). A total of three adults and four juveniles were observed at these colonies (Table 3). Marmot colonies were also encountered at the Head Smashed In Heritage site, approximately 20 km west of Fort McLeod (D. Young, pers. comm. 1985) and at a site on the Oldman River, 5 km upstream of that river's confluence with the St. Mary River (D. Fernet and C. Bjornson, pers. comms. 1985). Residents interviewed within the Study Area reported observations of marmots, principally in the vicinity of the C.P.R. railway bridge across the Castle River; as described above, a colony of yellow-bellied marmots was located at this location during the course of this study.

4.1.2 Life-history Description

4.1.2.1 Biology

Yellow-bellied marmots enter their dens in late August and hibernate until early spring (Wooding 1982). Wooding (1982) explains that

TABLE 3

KEY SPECIES OBSERVED WITHIN THE OLDMAN RIVER STUDY AREA, SUMMER, 1985

Key Species	Resident Population ¹		Nests		Dens/Colonies
	Within Reservoir	Outside Reservoir	Within Reservoir	Outside Reservoir	Within Reservoir
Yellow-bellied marmot	7	0			2
Badger	unknown	unknown			
Long-tailed weasel	unknown	unknown			
Mule deer	approx. 200 ²	unknown			
White-tailed deer	approx. 10 ²	unknown			
Peregrine Falcon	0	0			
Ferruginous Hawk	2	6+	1	2	
Prairie Falcon	11+	17+	4	5	
Merlin	3	0			
Burrowing Owl	unknown	unknown			
Canada Goose	26	39			
Northern leopard frog	0	unknown			
Western painted turtle	0	unknown			

¹ Includes adults and young.² Numbers are estimates of deer frequenting the reservoir based on actual deer observations on summer range during preferred survey conditions in fall, 1985 (L. Allison, pers. comm. 1986).

mating occurs soon after hibernation is complete and that an average of five pups are born 30 days later.

4.1.2.2 Habitat Preferences

Yellow-bellied marmots range from British Columbia and southern Alberta, south through eastern California, west to Colorado and northern New Mexico, and north to Montana (Whitaker 1980). They prefer rocky environments, talus slopes, valleys and foothills, with some populations utilizing abandoned mining or logging camps (Wooding 1982; Whitaker 1980). They usually occur in small colonies presided by a dominant male or occasionally a dominant female (Wooding 1982). Wooding (1982) further describes their preference for hot, arid habitats at low subalpine elevation of up to 3 660 m. Marmots usually maintain two types of burrows: a main burrow in which they hibernate and young are born, and auxiliary burrows used for temporary shelter against unfavourable weather or predators (Wooding 1982). The entrances are usually through narrow openings in boulders and rocks.

Marmots spend most of their daylight hours foraging for food or sunning on boulders or rocks near their burrows. Large quantities of green grasses and vegetation are consumed to store fat for winter hibernation (Wooding 1982).

The two marmot colonies in the Study Area were located within masses of boulders which had collapsed from the cliff faces of the Castle River or which had been placed at the base of the C.P.R. bridge supports as rip-rap to protect that structure from erosion. The colonies were located within vegetation type 1A (Reid et al. 1985); grassy slopes immediately adjacent to these boulder fields provided a readily available food source for these animals.

4.1.3 Impact Assessment

The proposed reservoir will inundate both yellow-bellied marmot colonies. These animals have demonstrated an ability to colonize new areas in recent years but suitable habitat must be present in the form of talus slopes or boulder piles. Slumping resulting from reservoir creation may provide such habitat on the long-term but in the short-term, the existing animals will be displaced.

4.2 LONG-TAILED WEASEL

4.2.1 Population Status

The long-tailed weasel is classified as a "threatened" species in Canada (COSEWIC 1985). This species' range does overlap the Study Area (Soper 1964; Banfield 1974; Simms 1979; Gamble 1981). Westworth (1985) reported that this species was historically common throughout the prairie provinces but that numbers have declined during the last several decades. Nonetheless, Gamble (1981) reported that long-tailed weasel populations are relatively stable due to this species' adaptability in diet whereas other species such as the ermine and least weasel have more specialized diets and are subject to periodic population fluctuations.

The status of long-tailed weasels in the Study Area is poorly understood. Local landowners reported that "weasels" are common in the river valleys and are seen most commonly during winter. J. Russell (pers. comm. 1986) has observed all of three species of weasel in the vicinity of Pincher Creek. No weasels were observed during the course of the field investigations.

4.2.2 Life-history Description

4.2.2.1 Biology

Long-tailed weasels are year-round residents of the ranges they occupy. Young are born in the spring, with litter sizes ranging from four to eight animals. Young animals grow rapidly and disperse along waterways during the fall to other suitable habitat (Savage and Savage 1981; Gamble 1981).

4.2.2.2 Habitat Preferences

Gamble (1981) described that long-tailed weasels prefer late seral stages or ecotones where prey diversity is greatest. Like other weasels, this species preys largely upon small rodents, although their diets also include a variety of other items including birds, eggs, herpetofauna and berries (Simms 1979; Gamble 1981; Savage and Savage 1981). Unlike other weasels, the long-tailed weasel is capable of adjusting its diet to take advantage of an abundance of prey items (Gamble 1981).

Long-tailed weasels may utilize abandoned burrows of other mammals (Soper 1964), although the presence of water in close proximity to dens appears to be an essential factor in determining the distribution of this species (Gamble 1981). Watercourses are evidently utilized as travel corridors and a means for dispersal (Gamble 1981). The home range of this species is poorly understood but appears to vary from as little as 0.8 ha to as much as 121 ha (Banfield 1974; Rue 1981).

As no weasels were observed during the course of 1985 field investigations, habitat utilization can only be inferred from the literature and habitat types in the Study Area. Long-tailed weasels might be expected to utilize any of the river valley habitats, in particular the margins of different vegetation types (Reid et al. 1985) where prey abundance would be greatest. These animals also exploit man-made structures

such as sheds and barns in the Study Area as a source of shelter and prey such as mice.

4.2.3 Impact Assessment

Reservoir creation will displace any long-tailed weasels residing in the three river valleys. This species does, however, appear to be adaptable and has demonstrated an ability to coexist with human activities, exploiting prey items associated with farm buildings. Ranch or farm yards in association with remaining shrubland or forests will provide suitable habitat for what would likely be a small number of displaced animals.

4.3 BADGER

4.3.1 Population Status

The badger occurs on the COSEWIC (1985) list but is not considered rare, threatened, or endangered. Concern over the effect of continued intensive agricultural practices and other human disturbances has resulted in the inclusion of the badger on the list (Westworth 1985). The status of badger populations in Alberta is poorly understood (Alberta Energy and Natural Resources 1984).

Soper (1964) states the normal provincial range of badgers includes all of the southern plains, north through the prairies and parklands to about the North Saskatchewan River. In the southwestern portion of the province, a few range westward into the foothills and mountains. In earlier times it is apparent that badgers occasionally wandered north of the Saskatchewan River to the Athabasca and Peace rivers. As late as 1919 the species was still fairly common in the Islay-Vermillion country, north to about Dewberry. Now relatively few are left in any of the well-settled territory of south and east-central Alberta.

This species was subjected to intensive harvesting between 1925 and 1930, when between 5 000 and 17 000 were taken annually (Alberta Energy and Natural Resources 1984). Low populations and low pelt prices have stabilized the number of pelts sold to a point now where approximately 2 000 animals per year are harvested.

No information exists on the status of the badger in the Study Area. Soper (1973) found a limited population in Waterton Lakes National Park, with a fair number of dens where favourable conditions prevailed. Landowners interviewed during this study revealed that badgers are common although most interviewees suggested that badgers were usually observed above the river valleys. Diggings were regularly observed but no confirmed badger dens were discovered. One resident observed a badger adult carrying a young badger in an upland area above the furthest upstream extent of the reservoir on the Crowsnest River (Figure 3A in Appendix III).

4.3.2 Life-history Description

4.3.2.1 Biology

Mating occurs in August-September and as in most members of the family mustelidae, sperm implantation is delayed until mid-February (Soper 1973). From 2-5 young are born after a 6 week gestation period (Wooding 1982). Wooding (1982) describes the nursery den as a large chamber in a burrow deeper and larger than usual. The young remain with the female until early autumn, with the male playing no part in rearing of the young. Summertime burrows are seldom occupied more than a single day (Savage and Savage 1981). Badgers do not hibernate but do seek shelter and will also sleep during severe weather; in northern ranges they experience periods of torpidity and will remain within the den for several weeks (Wooding 1982).

4.3.2.2 Habitat Preferences

Badgers are found in the western United States ranging east to eastern Texas, Oklahoma, northern Missouri, northern Illinois, northern

Indiana, northern Ohio, north to southeastern British Columbia, Alberta, Manitoba and Saskatchewan (Whitaker 1980). They prefer open prairie, bushy bottomlands and sometimes the edges of aspen groves (Soper 1973).

Badgers rarely associate with each other except during the mating season but males may share a home range with 2-3 females (Savage and Savage 1981). Home ranges of males are less than 7.8 km^2 and female home ranges are in the order of 2.6 km^2 .

Badgers often have an involuntary relationship with coyotes, where the coyote often follows a hunting badger, catching ground squirrels that the badger has flushed (Wooding 1982).

Badgers primarily consume rodents such as ground squirrels, pocket gophers, mice and moles, with birds, birds' eggs and insects, especially bumble bees also being consumed (Savage and Savage 1981). They often bury surplus food.

As described above, no badger dens were located in the Study Area. Badger diggings were regularly encountered in the upper portions of the valleys and in upland grassland areas classified as vegetation type 1A (Reid et al. 1985).

4.3.3 Impact Assessment

Although no badgers were observed, this species almost certainly occurs in the vicinity of the proposed reservoir. Grassland areas above the valleys appear to be utilized to a greater extent than the valleys themselves. As a result, the numbers of badgers displaced by the reservoir are expected to be minimal. Given that the grassland areas above F.S.L. are extensive (Table 2), these areas can be expected to accommodate any animals displaced from flooded areas.

4.4 MULE DEER AND WHITE-TAILED DEER

4.4.1 Population Status

Both mule deer and white-tailed deer range throughout Alberta but in the Study Area, the latter is much less common (Soper 1964; Gudmundson 1982; Westworth 1985). Various investigators have described the Study Area's importance as mule deer wintering range (Horesji et al. 1978; Gudmundson 1982; Allison and Russell 1985). Gudmundson (1982) reported 97 mule deer in a portion of the Oldman River between the Summerview bridge, approximately 7 km downstream of the proposed dam site and the Tennessee Creek confluence, approximately 6 km upstream of the proposed dam site. Allison and Russell (1985) estimated that from 240 to 340 mule deer, and from 10-20 white-tailed deer frequented the proposed reservoir area during winter.

Horesji et al. (1978) and this study also concluded that the Study Area constitutes excellent summer range for mule deer. Horesji et al. (1978) estimated that approximately 150 deer were present in April, 1978.

This study concluded that approximately 200 mule deer and 10 white-tailed deer frequented the proposed reservoir area during summer, 1985 (Table 3). The EMA field crew observed a total of 124 animals in 11 days. The Salix field crew encountered 104 deer during five days (Figure 4 in Appendix IV). Because the EMA surveys focussed on species other than deer, they were conducted differently than the later Salix surveys. The 124 early sightings by EMA have a high probability of including repeat sightings of the same animals. The entire Study Area was surveyed three times, once by air and twice by boat. In addition, foot-based surveys were conducted between the floodplain and the river valley crests. In contrast, the Salix crew began at the upstream ends of the proposed reservoir, and worked downstream, with little overlap in areas covered. The possibility of having encountered the same individual deer more than once remains, but is considered lower for the Salix surveys. Sightings known to be repeat observations were excluded.

The probability of not seeing deer when surveying in summer is extremely high, because visibility is restricted by cover, and deer are in small groups. It is likely that many more deer were missed than were counted twice. The 104 deer observed should be considered a minimum number using the reservoir in summer, and the likely number is at least twice as high, as approximately 200 mule deer were observed still on summer range under optimal survey conditions (snow was present) during fall, 1985 (L. Allison, pers. comm. 1986).

Of the total summer observations of deer (228), 193 were adults or yearlings and 35 were fawns. Fawns represented 18 percent of the total number of animals seen. The ratio of fawns to does during the Salix foot-based surveys (in which the probability of seeing fawns was considered higher) was 43:100. Because does are secretive and fawns are hard to see early in the summer, the figures presented are not considered an accurate representation of the proportion of fawns in the population; they are minimum numbers.

Of the 228 summer observations of deer, 64 observations or 28 percent were above the designed F.S.L. of the reservoir and 164 observations or 72 percent were below, within the impoundment area. In general, animals were more easily observed in areas above F.S.L. where vegetation cover is generally quite sparse relative to the floodplain areas. Nonetheless, all of the deer seen on the surveys probably use the reservoir area below F.S.L. for shelter, for feeding, and for access to water.

4.4.2 Life-history Description

4.4.2.1 Biology

The rut (breeding period) for deer in southern Alberta occurs largely in November. Mixed-sex herds are common for both species during winter and while animals may be distributed rather widely during mild

weather conditions, they tend to become more concentrated with increased severity of winters (Hart and Hunt 1980).

Some dispersal occurs during spring and females isolate themselves for fawning in June. During summer, deer occur in small aggregations (Banfield 1974; this study); this study observed average group sizes of 2.0 animals, frequently composed of a doe and fawn. With the onset of fall, both species, particularly mule deer become gregarious and tend to associate as herds through the winter.

4.4.2.2 Habitat Preferences

Due to their adaptability in habitat utilization and diet, white-tailed deer are capable of exploiting a variety of habitat types. White-tailed deer habitat preferences may vary seasonably but where a broad diversity of habitat occurs, their seasonal requirements can be met in a fairly confined area. The variable topographic features and land-use practices of "parkland" areas of Alberta provide optimal conditions for this species (Ripplin 1977; Wishart 1984). During summer, this species will frequent deciduous and mixed-wood areas, and cultivated lands also enhance the likelihood of their occurrence (Vriend and Clark 1975; Hart and Hunt 1980). During winter, large expanses of trees and shrubs afford a readily-available food source and protection from adverse weather conditions. When high-quality forage crops are available, white-tailed deer will spend much of the winter in agricultural fields (Swenson et al. 1983; Allison and Russell 1985). Fawning areas are generally associated with dense vegetation near wetlands or drainages (Harmoning 1976; Hart and Hunt 1980).

Mule deer are relatively sedentary; their habitat requirements are usually met within confined areas, typically characterized by high relief terrain (Soper 1964; Martinka 1968; Mackie 1970; Kramer 1972; Wallmo 1981; Swenson et al. 1983). While mule deer frequent forested areas, particularly in montane regions, high densities also occur along prairie river valleys such as are found in the Study Area (op. cit. and Allison and

Russell 1985). Snow-free south and west-facing slopes are frequently utilized during winter (Vriend and Clark 1975; Young 1981a, b; Allison and Russell 1985). Rough topography is utilized during winter and these areas may or may not include coniferous cover. Where coniferous cover is present, mule deer use these areas for thermal cover during adverse weather (Swenson et al. 1983). In areas lacking coniferous cover, local topography such as coulee breaks provide some protection from adverse weather but as Swenson et al. (1983) and Moen (1968) concluded, the availability of high quality forage may offset the energy losses associated with frequenting open habitat.

During spring, females frequent coulee breaks and dense cover, near water for fawning. Thomas (1979) described optimal fawning locations as being small wooded areas (0.4 to 2.0 ha) with a 50 percent canopy cover, a dense shrub understory and within 183 m of potable water. Islands were found to be important fawning sites during this study, a situation which has been described for other cervids and deer in other locations (Shoesmith and Storey 1977).

During summer, deer are widely distributed in a broad diversity of habitats ranging from dense shrub zones to open, grassed slopes and cultivated fields (this study).

White-tailed deer and mule deer diets are similar, with browse and forb species constituting the chief components of their diets. Spring diets include some residual vegetation but new growths of forbs, grasses and leaves are exploited as they become available (Dusek 1975; Wallmo 1981; Wishart 1984). Browse assumes greater importance during summer and fall; fall diets are supplemented with fruits of shrubs and waste grain from croplands (op. cit.). Winter diets are largely composed of browse, with saskatoon, common chokecherry, aspen, willow, rose and snowberry representing preferred species (op. cit.; Hart and Hunt 1980).

During this study, does with young fawns were observed on islands and in dense cover on sheltered slopes. Such locations were close to

water, conforming with descriptions in the literature (Thomas 1979). Even when deer were not observed on islands, tracks were numerous. Most groups observed were in or near cover. Cover ranged from dense, tall cottonwoods to sparse cottonwoods on floodplains or within saskatoon shrubs. In general terms, deer frequented vegetation types 1A, 2A and 3 in decreasing order of frequency (Table 4).

Deer are opportunistic feeders during summer; the deer in the Study Area seemed to spend large amounts of time in cultivated fields feeding on forage and grain crops, particularly within irrigated fields. In most years the crop itself is tall enough to provide does and fawns with cover. In 1985, drought in the Study Area was severe, and crops in many areas were sparse and less than 20 cm tall, insufficient for hiding deer.

Deer habitat utilization was analyzed according to observations made in June, and observations made after June (Table 5). Early surveys were conducted when fawns were very young, and it was thought that differences in habitat choice might appear. The major difference in the two data sets was that a greater number of deer were seen in trees and shrubs (vegetation types 2A, 4, 5 and 6) later in the summer, except for the floodplain cottonwoods (vegetation type 3) in which more deer were observed in June (Table 5). No conclusions about habitat use can be drawn from Table 5. In our opinion, differences in sampling method between the early boat-based and air surveys and the later foot-based surveys can explain the differences. Observations made during boat-based surveys would tend to be weighted toward observing animals near or beside the river - thus explaining the high number of observations in floodplain cottonwoods. Other deer sightings during June were heavily weighted toward habitats in which deer were easiest to see, as the early EMA surveys were not designed to locate deer. The later work by Salix was specifically designed to locate deer, and the field crew searched areas of cover to find them, with the unsurprising result that more observations in the later part of the summer were in areas of dense cover.

Deer appeared to select habitat types which provided cover and food - shrubs and cottonwood and aspens - and for the wheat grass/June

TABLE 4

HABITAT UTILIZATION BY DEER IN THE OLDMAN RIVER STUDY AREA, SUMMER, 1985

Location/River Segment ¹	Vegetation Type									
	1A	1B	2A	2B	3	4	5	6	C	TOTAL
Oldman River										
OM - 25b	14		7	4	3				2	30
OM - 26	16		3	10	19					48
OM - 27	13		17	6	5		9	6		56
OM - 28	4		5		14	10		1	7	41
Total	47									
Crowsnest River										
CR - 1	15	4	6	9	10			5	1	50
Castle River										
C - 1	31	6	20	6	7	12		4	6	92
TOTAL (% Total)	93(29)	10(3)	58(18)	35(11)	58(18)	22(7)	9(3)	16(5)	16(5)	317

¹ River segments as described by Allison and Russell (1985).² From Reid et al. (1985)

1A - Western wheat grass/June grass

1B - Rough fescue - oat grass

2A - Saskatoon - choke cherry

2B - Skunk bush - creeping juniper

3 - Cottonwoods

4 - Aspen

5 - Limber pine

6 - Douglas fir

C - Cultivated

TABLE 5
HABITAT UTILIZATION BY DEER IN THE OLDMAN RIVER STUDY AREA,
JUNE AND JULY/AUGUST, 1985

Survey Period	Vegetation Type									TOTAL
	1A	1B	2A	2B	3	4	5	6	C	
June										
(no. deer)	34	1	12	10	33	3	0	3	0	96
(% Total)	(35)	(1)	(13)	(10)	(34)	(3)		(3)		
July/August										
(no. deer)	59	9	48	16	29	19	9	13	6	208
(% Total)	(28)	(4)	(23)	(8)	(14)	(9)	(4)	(6)	(3)	

¹ Vegetation Types as described in Table 4 and Reid et al. (1985).

grass grassland areas (Table 5). The rough fescue/oat grass (1B) and the limber pine habitat (5) are limited in area (Table 2) and few deer were observed in these areas (Table 5).

Deer observations were also broken into age and sex groups (excluding unidentified adults), and white-tailed deer were separated from mule deer for habitat analysis (Table 6). Differences appear between all groups, although sample sizes are small. Bucks were located in the open or shrubby areas proportionately more than does. Until fawns began to travel more widely with the does late in the summer, fawn sightings were largely fortuitous. The fawn habitat utilization reflects the ease of spotting fawns in particular habitat types as well as the types of habitat they use. Only 12 white-tailed deer were seen, and there were no obvious differences in habitat type utilization or locations of sightings among those deer or between them and mule deer (Table 6).

4.4.3 Impact Assessment

The proposed reservoir will result in the direct loss of a high proportion of currently available mule deer habitat. Direct habitat loss will occur from both flooding and subsequent slumping.

Habitat requirements for fawning mule deer (i.e., dense cover and nearness to water) are abundant in the valleys of all three rivers below the reservoir F.S.L. Islands are known to be important fawning locations for other cervids and for deer in other areas (Thomas 1979; Shoesmith and Storey 1977). There is no alternative fawning habitat available above F.S.L. except in the tributary creeks and other parts of the river valley, which are areas that already support summering populations of mule deer. Preliminary information on reservoir operation suggests that under average conditions, drawdown of the reservoir for irrigation purposes will not occur prior to mid-late June (L. Sjojka, pers. comm. 1986). Fawning of mule deer occurs in early June (Banfield 1974; this study). If, however, this operating regime was to change and drawdown was to occur earlier,

TABLE 6
HABITAT UTILIZATION BY DIFFERENT AGE AND SEX GROUPS OF DEER,
IN THE OLDMAN RIVER STUDY AREA, SUMMER, 1985

Species	Vegetation Type									TOTAL
	1A	1B	2A	2B	3	4	5	6	C	
Mule Deer										
Bucks	11	3	10	2	8	2			2	38
Does	61	5	39	21	33	17	5	11	11	203
Fawns	12	2	6	3	4	1	4	4	3	39
Total (% Total)	84(30)	10(4)	55(20)	26(9)	45(16)	20(7)	9(3)	15(5)	16(6)	
White-tailed Deer										
Bucks			1							
Does	1		2		3	2				
Fawns					3					
Total (% Total)	1(9)		3(27)		6(55)	2(18)				12

¹ Vegetation types as described in Table 4 and Reid et al. (1985).

does with fawns on the margin of the reservoir would have to cross a widening mudflat without cover to reach water. Otherwise suitable fawning locations may be avoided for this reason. Thomas (1979) indicated that fawning sites are within 183 m of water. Furthermore, extensive slumping is expected to occur along the reservoir's shoreline resulting in the creation of sheer cliffs which would likely inhibit access to water by deer (L. Sjojka, pers. comm. 1986).

Coulees and brush above the waterline and slump lines of the reservoir will remain as suitable summer habitat but the area will be relatively small, and those areas are currently used by deer. Both winter (Allison and Russell 1985) and summer observations suggest that mule deer are using coulees as escape terrain and travel routes between the river valley and the uplands. In areas of the reservoir where the F.S.L. approaches the top of the river valleys, the upper section of tributary coulees will provide the only cover available for mule deer, and potential escape terrain will be severely limited.

Reservoir creation will not have a significant effect on populations of white-tailed deer in the area. Few summering white-tailed deer were seen during the present study and populations are known to winter above the reservoir on all branches of the river as well as downstream of the proposed dam (Allison and Russell 1985).

In contrast, the relatively large numbers of mule deer that are year-long residents of the portions of valleys to be flooded will all be displaced from their permanent habitat, and any additional mule deer wintering in the area will also be displaced. Displaced animals may ultimately be lost to the population as all suitable habitat in the vicinity of the reservoir is currently occupied by deer (Allison and Russell 1985).

Short-term impacts in terms of disturbance to resident deer can be anticipated during the construction phase of the project; the magnitude of the impact will depend upon the distribution of deer at the time of various construction-related activities.

4.5 CANADA GOOSE

4.5.1 Population Status

Alberta Energy and Natural Resources (1984) concluded that the province provides habitat for about 46 000 breeding pairs of large Canada Geese each spring. Populations in general have increased over the years, with an estimated 3 million geese in the United States in September 1974 (Bellrose 1976). Bellrose (1976) states that during the 20-year period 1955-1974, the population in the Atlantic, Mississippi and Central flyways increased by 138.6 percent, 169.5 percent and 70.6 percent respectively.

The Study Area's capability for waterfowl production is very low (Canada Land Inventory 1970; 1973). Horejsl et al. (1978) and Prism (1982), cited in Westworth (1985), have documented the occurrence of nesting Canada Geese in the area of the proposed reservoir. Surveys conducted downstream of Lethbridge show a moderately high production of Canada Geese along the Oldman River (Froggatt 1979; Froggatt 1981 cited in Westworth 1985).

All landowners interviewed in the Study Area reported geese nesting in the river valleys. During the course of the three surveys, totals of 19 and 157 adult Canada Geese were observed within and outside (downstream and upstream) of the proposed reservoir respectively (Table 7). The resident population within the reservoir was estimated to be 26 birds (Table 3). No Canada Goose nests were discovered during nest searches but the likelihood of finding nests was low as the study commenced after hatching had occurred in 1985. An equal number of Canada Goose broods (five) was encountered within and outside (downstream and upstream) of the proposed reservoir (Table 8). Assuming that all the broods observed were derived from nests in the Study Area, and that all pairs successfully produced broods, the density of nesting pairs would have been 0.1 pairs/km of river. This value is considerably lower than 1.0 nesting pairs/km reported by McDonald (1975) for the Bow and Highwood rivers in southern Alberta.

TABLE 7

NUMBER OF ADULT WATERFOWL OBSERVED WITHIN AND OUTSIDE THE PROPOSED RESERVOIR, SUMMER, 1985

Species	Helicopter Survey Jun 5		Float Survey I Jun 6-8		Float Survey II Jul 16, 18-19		TOTAL
	Within Reservoir	Outside Reservoir ¹	Within Reservoir	Outside Reservoir	Within Reservoir	Outside Reservoir	
Canada Goose	13	7	6	11		19	157
Mallard	22	69	32	58	5	139	130
Green-winged Teal			2	2	1	3	2
American Wigeon	2	9	6	3		8	12
Northern Pintail	2	2	1			3	2
Blue-winged Teal	1		2	2		3	2
Canvasback			1			1	
Barrow's Goldeneye			1			1	
Common Merganser	21	42	41	48	5	6	96
Red-breasted Merganser	1					1	
Hooded Merganser					1	1	
TOTAL	62	129	92	124	12	148	401

¹ Upstream of the proposed reservoir in the designated buffer zones and downstream, in the area between the proposed damsite and the L.N.I.D. weir.

TABLE 8
NUMBER OF WATERFOWL BROODS AND NESTS WITHIN AND
OUTSIDE THE PROPOSED RESERVOIR, SUMMER, 1985

Species	Nests		Broods	
	Within Reservoir	Outside Reservoir ¹	Within Reservoir	Outside Reservoir
Canada Goose			5	5
Dabbling Ducks				
Mallard	1		1	1
Northern Pintail	1			
Blue-winged Teal	1			
Diving Ducks				
Common Merganser			5	6
TOTAL	3		11	12

¹ Upstream of the proposed reservoir in the designated buffer zones and and downstream, in the area between the proposed dam site and the L.N.I.D. weir.

4.5.2 Life-history Description

4.5.2.1 Biology

Sadler and Myres (1976) concluded that spring migration in Alberta consists of three movements. Geese breeding in southern Alberta arrive in small flocks as early as late February or during March; smaller northern races pass through in April and finally non-breeding geese arrive during late May and early June. In autumn, the northern-breeding Canada Geese arrive in eastern Alberta about mid-September and are mostly gone by late October; larger geese that breed locally linger later in the autumn.

Considerable variation exists in the timing of nest initiation in western races of Canada Geese (Bellrose 1976). McDonald (1975) found that nesting in the Bow River Basin, Alberta commenced around 13 March, 1970 and peak egg laying occurred from 25 to 28 March. Caldwell (1967) found that peak egg laying occurred during the second week in April, 1962 on a portion of the South Saskatchewan River.

The average clutch size of various races of Canada Geese is 5.14 eggs (Bellrose 1976). McDonald (1975) observed a mean clutch size of 5.8 eggs on the Bow-Highwood study area in 1971-72 while Caldwell (1967) found the number of eggs per nest varied from 3 to 8, with the overall average also being 5.8 eggs.

Renesting among some Canada Geese occurs in certain areas (Bellrose 1976; Caldwell 1967). In Montana, Atwater (1959) found 18 percent renesting of Canada Geese while Geis (1956) indicated that 30 to 40 percent of unsuccessful pairs made renesting attempts in the Flathead Valley of Montana.

Female giant Canada geese incubate for 25-30 days, with the average ranging from 26 to 28 days (Bellrose 1976). In southeastern Alberta, Vermeer (1970) found that incubation ranged from 25 to 28 days and averaged 28 days. In 1970, peak hatching along the Bow River Basin

occurred from 1 to 4 May, with some hatching as late as 18 May (McDonald 1975). Along the South Saskatchewan River in 1962, nests hatched between 15 and 26 May (Caldwell 1967).

Both parents escort their young from the time they leave the nest through the brood period (Bellrose 1976). On some western rivers, broods drift downstream many miles from island or canyon nest sites to favourable feeding meadows (Bellrose 1976). Gang broods are fairly common with some broods amalgamating after the goslings are 5 to 7 days old (Bellrose 1976). Both McDonald (1976) and Caldwell (1967) found that broods commonly moved downstream in search of suitable brooding habitat. Generally movement is fairly short (i.e., from 1 to 3 km); however Caldwell (1967) cites one case where a gosling travelled a distance of 50 km in eight days.

Females normally precede their mates in the post-nuptial wing molt by a week to 10 days, when the young are between 30 and 50 days old (Johnsgard 1975). Adults regain their flight feathers about the time their young are capable of flight (Bellrose 1976). Goslings of giant Canada Geese at Seney Refuge, Michigan attained flight at about 71 to 73 days while goslings of the interior race fledged in about 63 days (Bellrose 1976).

4.5.2.2 Habitat Preferences

The Canada Goose breeds from northern United States north to the Arctic, breeding locally in all parts of the Prairie Provinces including the Rocky Mountains (Salt and Salt 1976). Godfrey (1966) describes the Canada Goose as breeding over vast, ecologically varied areas in both treeless and forested country. Nests are usually close to lakes, ponds and larger streams, marshes, muskegs, and hummocky coastal plains. Canada Geese have taken readily to man-made structures such as galvanized washtubs, wicker baskets, and artificial islands (Bellrose 1976; Giroux 1981).

McDonald (1975) found that 106 nest sites (58.5 percent) were on river islands and 41.5 percent were on the mainland; 69 nests (65.1 percent) were on the ground, 22 (20.7 percent) were on cliffs and 15 (14.1 percent) were in trees. Caldwell (1967) noted that all but one of the 140 nests found the South Saskatchewan River study area were on islands and none were off the ground. Caldwell (1967) further stated that a preferred nest site on islands was near the edge of a steep bank overlooking the water or at the upstream or downstream tip of the island. McDonald (1975) found that ground-nesting geese usually occupied the highest sites available on islands, utilizing natural knolls, gravel mounds pushed up by ice action and driftwood piles. Ground nests are usually less than 30 m from the water, with cliff and tree nests occasionally more than 30 m from water (McDonald 1975; Caldwell 1967). Ground nests within the Bow River Basin ranged from 0.3 to 3.6 m above the river water level while several cliff nests were estimated to be over 60 m above the river (McDonald 1975).

Nesting sites on south and west-facing slopes are usually selected when available as east and north-facing slopes are usually covered by ice and snow or are extremely wet due to slow thawing of the ground (McDonald 1975). Nesting cover varies from heavy, thick cover to short grass and low shrubs, bare sand or piles of driftwood (McDonald 1975; Caldwell 1967). Concealment seems to be less important than visibility and the opportunity for rapid escape (Caldwell 1967). Actual nesting material varied on the South Saskatchewan River from mere depressions in bare sand to structures of willow twigs, stems of horsetail, clover and/or grass, with down usually plentiful in nests that contained the full complement of eggs (Caldwell 1967).

Nesting density in the Bow-Highwood study area (McDonald 1975) averaged 1.0 nesting pair per km of river compared to a range of 0.5 to 2.2 pairs per km of river in other studies (Craighead and Craighead 1949; Gels 1956; Culbertson et al. 1971).

Most studies of food habits of Canada Geese are of wintering or migrating birds and may not be typical of breeding birds (Johnsgard 1975).

Predominantly a grazing species, these birds have readily adapted to consumption of feed grains, cereals, and green forage (Bellrose 1976). Natural foods consumed include such plants as cordgrass, salt grass, sago pondweed, wigeon grass, hardstem bulrush, spike rush and horsetail.

Landowners interviewed in the Study Area reported that Canada Geese nested on mid-river islands, within floodplain forests (vegetation type 3 - Reid et al. 1985) and also on cliff faces. These observations concur with the results reported by both McDonald (1976) and Caldwell (1967) for geese nesting on rivers in southern Alberta and Saskatchewan. Adult geese and their goslings were observed grazing along the rivers' edge and as the goslings grew larger, these family groups also exploited vegetation within nearby irrigated croplands in the Study Area.

4.5.3 Impact Assessment

Reservoir creation will result in the loss of nesting habitat for Canada Geese. Approximately 100 km (47.5 km x 2 shorelines) of shorelines plus in excess of 20 ha of island would be inundated by the proposed reservoir (Table 1). Although densities of nesting Canada Geese could not be determined, the number of goose broods encountered within the proposed reservoir area led us to conclude that densities of nesting Canada Geese in the Study Area were low. Canada Geese are extremely adaptable as far as nest site selection is concerned. Once old nesting locations are inundated, geese will rapidly select other nesting sites either on or close to the reservoir. Within the buffer zones delineated in this study, approximately 60 ha of potential nest sites were present in the form of islands (Table 9). Furthermore, the shorelines of the rivers upstream and downstream of the reservoir, and cliff ledges along those shorelines would continue to provide suitable nesting habitat for geese. These areas are currently frequented by geese in low densities and should be capable of sustaining the small numbers of displaced birds. The shorelines of the reservoir itself may or may not provide suitable nesting habitat, depending upon when the reservoir is drawn down. Preliminary operational plans for

TABLE 9

ESTIMATE OF THE AMOUNT OF POTENTIAL GOOSE NESTING HABITAT ABOVE THE RESERVOIR F.S.L., IN THE BUFFER ZONES OF THE STUDY AREA AND IN THE AREA BETWEEN THE PROPOSED DAM SITE AND THE L.N.I.D. WEIR, SUMMER, 1985

Locations	Potential Goose Nesting Habitat
Above Reservoir F.S.L.	Reservoir shoreline.
Crowsnest River Buffer	Existing shoreline.
Oldman River Buffer	Existing shoreline + 0.02 ha of island.
Castle River Buffer	Existing shoreline + 1.0 ha of island.
Dam to L.N.I.D. Weir Buffer	Existing shoreline + 58.88 ha of island.
TOTAL	Shorelines + 59.90 ha of island.

the reservoir indicate no drawdown earlier than June (L. Sjojka, pers. comm. 1986) and thus the reservoir's shorelines could provide suitable nesting habitat as the nesting birds would be close to water. Furthermore, slumping shorelines could provide cliff-faces with ledges for nesting geese. Conversely, if the operational regime of the reservoir was to change and drawdown was to occur prior to hatching in mid-late May, Canada Goose broods would be vulnerable to predation while crossing unvegetated mudflats.

The potential also exists for the reservoir to develop into a staging area for Canada Geese. Nonetheless, as this area of the province does not lie within a major goose migration corridor, there is little likelihood of this reservoir harbouring large numbers of geese.

4.6 DUCKS

4.6.1 Population Status

The Study Area lies within the Pacific flyway (Chase 1964) and as such, straddles a major migration corridor for ducks breeding on or north of the Study Area. The Prairie Pothole Region of North America which incorporates the Study Area is renowned for its waterfowl production and staging capability (Munro 1969; Bellrose 1976, 1979). The Study Area under investigation falls within the waterfowl habitat classification of "Shortgrass Prairie" (Bellrose 1979). The Shortgrass Prairie area is notable for its abundance of wetlands during "wet" years and high densities of breeding ducks, particularly Mallard, Northern Pintail, American Wigeon and Lesser Scaup. The Study Area lies on the extreme western edge of the Shortgrass Prairie area and due to a series of "dry" years, few naturally occurring wetlands are present. As described in Section 4.1.5.1, the Study Area's capability for waterfowl production is very low (Canada Land Inventory 1970; 1973). The three major rivers in the Study Area do not constitute optimal habitat because of their high velocity and lack of preferred marsh conditions. Consequently the rivers are inhabited

principally by the most adaptable of species such as Mallard and species like Common Merganser which prefer riverine conditions.

During the course of three surveys of the Study Area, totals of 166 and 401 adult ducks were recorded within and outside (downstream and upstream) of the proposed reservoir respectively (Table 7). June represented the time of maximum utilization of the Study Area by ducks (Table 7). Mallard and Common Merganser represented the most commonly observed dabbling duck and diving duck species respectively (Table 7). Three duck nests were discovered during island nest searches, with all three belonging to dabbling duck species (Table 8). Thirteen duck broods were observed (all Mallards and Common Mergansers), with six encountered within the proposed reservoir and seven outside (downstream and upstream) of the reservoir (Table 8).

4.6.2 Life-history Description

4.6.2.1 Biology

Spring-migrating waterfowl typically arrive in the region during April and early May, with Mallards and Northern Pintails representing the earliest migrants. If drought conditions exist upon the birds' arrival, birds either concentrate on remaining waterbodies or overfly the prairies, frequenting instead areas to the north which have more stable water conditions (Hansen and McKnight 1964; Smith 1970; Calverley and Boag 1977). Migrating birds, including those on staging areas, generally associate in flocks although most females are paired by the time they arrive in their breeding areas (Weller 1965). Despite this general pairing pattern, courtship in all species continues on the breeding grounds, with some individuals changing mates at this time.

Once migrant birds have departed, local breeding birds segregate into pairs and become intolerant of conspecifics. Individual breeding pairs defend portions of a waterbody which is referred to as a breeding

territory; these breeding areas vary in size depending upon species (Seymour 1974; Nudds 1980) but in general contain cover, food sources, loafing sites and potential nesting areas (Hochbaum 1944).

When egg-laying begins, the male remains alone in the breeding territory while the female is on the nest. As incubation of those eggs proceeds, the female spends a large proportion of time on the nest and the pair bond gradually weakens. The stability of the pair bond and the time at which the female is finally deserted varies widely among species. Once the pair bond dissolves, males begin to associate in all-male groups which gradually increase in size.

Dispersal to moulting areas is common among post-breeding waterfowl in late June and early July (Salomonsen 1968; Hochbaum 1955). Non-breeding birds or unsuccessful nesters also often depart the breeding grounds at this time. Successful breeding hens remain on the breeding grounds to attend their broods until they fledge, generally moulting in these areas (Gilmer et al. 1977).

Fall-migrating waterfowl begin to frequent the region as early as mid-August and will remain usually through October, although birds will often remain as long as open water is present. Overwintering at this latitude occurs occasionally, as portions of the rivers in the Study Area often remain ice-free throughout winter (Allison and Russell 1985).

4.6.2.2 Habitat Preferences

Spring-staging areas are characterized by shallow melt-water areas, open water on rivers, or wetlands with broad expanses of unvegetated water. During spring migration, waterfowl frequently feed on waste grain from the previous year's harvested crops. Preferred breeding habitat includes a variety of wetland types depending on the species involved, but an interspersed of open water and both emergent and submergent vegetation is generally the most productive condition (Weller and Fredrickson 1974; Voigts 1976; Kaminski and Prince 1981). Relatively permanent water is

essential to support broods, as is the presence of emergent vegetation for escape cover (Hudson 1983). Large standing crops of aquatic invertebrates are essential for egg-laying females (Krapu 1974; Swanson et al. 1974; Serie and Swanson 1976; Joyner 1980; Murkin et al. 1982) and duck broods (Collias and Collias 1963; Sugden 1973; Dannell and Sjoberg 1977).

Post-breeding habitat requirements vary from species to species but generally consist of large waterbodies and a stable food source (Oring 1964; Kortegaard 1974; Bailey 1983). Habitat requirements for fall-migrating birds also vary but larger waterbodies close to cereal croplands generally receive the greatest utilization (Bossenmaier and Marshall 1958; MacLennan 1973). Flowing water provides open-water conditions conducive to sustaining ducks late into the fall, and in the Study Area, such conditions allow over-wintering (Allison and Russell 1985).

Ducks were distributed in low densities throughout the Study Area, although the area between the proposed dam site and the L.N.I.D. weir did harbour more birds than did the proposed reservoir. The former area provides slightly better waterfowl habitat as the river becomes broader, there are more quiet backwater areas and oxbow marshes, and the river contains more aquatic macrophytes as a potential food source for ducks. Potential nesting cover is abundant both within and outside (downstream and upstream) of the proposed reservoir but the principal factor limiting waterfowl utilization is the presence of fast-flowing water and paucity of marsh conditions in the Study Area.

4.6.3 Impact Assessment

The proposed reservoir area is not a productive area for breeding waterfowl. Creation of the reservoir would likely displace some birds to surrounding areas which are quite capable of sustaining the small influx of birds. Some birds may establish breeding territories on the reservoir itself but newly hatched broods would be susceptible to predation during their movements across exposed mudflats to water.

Some potential exists for duck utilization of the reservoir by staging birds but the magnitude of such utilization is anticipated to be small.

4.7 FERRUGINOUS HAWK

4.7.1 Population Status

The Ferruginous hawk has been designated as "threatened" (COSEWIC 1985). Salt and Salt (1976) describes the Ferruginous Hawk as formerly commonly nesting in the prairie region of Manitoba, Saskatchewan and Alberta, particularly along river valleys and coulees. The limit of its breeding range was slightly north of the Red Deer River in Alberta but extended into the foothills southwest of Calgary. It occupies much of the same range today but in greatly diminished numbers. Alberta Energy and Natural Resources (1984) quote the current population of Ferruginous Hawks in Alberta to be in the order of 600-1 400 pairs. Schmutz (1982) felt that based on his estimate of 1 082 pairs of Ferruginous Hawks on his Alberta study area alone, that the actual number of nesting pairs in Canada may be considerably higher than 500-1 000 pairs estimated by Schmutz and Schmutz (1980). The entire population of Ferruginous Hawks in North America was estimated at 2 810-3 590 breeding pairs based on interviews with raptor biologists (Call, pers. comm. in Schmutz 1982). Young (1983), based on Schmutz's 1982 study, estimated the population of Ferruginous Hawks within the following watersheds as follows: Red Deer River, 218-504; Bow River, 54-126; Oldman River, 81-189; and South Saskatchewan River, 164-378.

Horejsi et al. (1978) did not observe any raptors during a reconnaissance flight over the proposed reservoir in 1976. Through personal interviews with landowners and Alberta Fish and Wildlife Division personnel, a nesting Ferruginous Hawk was reported just east of the northern edge of the proposed damsite (Horejsi et al. 1978).

Few landowners in the Study Area could reliably distinguish a Ferruginous Hawk from other large, broad-winged hawks. Consequently, no

nest sites of this species were reported by landowners. Three Ferruginous Hawk nests were encountered, one upstream and one downstream of the proposed reservoir on the Oldman River and one within the reservoir, on Todd Coulee, a tributary to the Crowsnest River (Tables 3 and 10; Figure 3A and C in Appendix III). Three pairs of adults and two young birds were observed (Table 3). The resident population within the proposed reservoir area was considered to be two adults (Table 3), as no young were observed at the nest site.

4.7.2 Life-history Description

4.7.2.1 Biology

The northernmost Ferruginous Hawks tend to be migratory, wintering somewhat south of the northern extent of their breeding range (Bent 1937). The wintering range for Ferruginous Hawks banded in Alberta includes New Mexico, Colorado, Kansas, Texas and Oklahoma (Snow 1974a). In Utah, north-migrating Ferruginous Hawks have been observed in late February - early March (Weston 1969; Smith and Murphy 1973). In Alberta, earliest arrivals appear at the end of March (Sadler and Myres 1976).

Most nests are probably constructed in March (Snow 1974a), with egg laying beginning in April, usually after the first week (Bent 1937; Schmutz 1977). A clutch of 3-5 eggs is laid (Godfrey 1966), with an incubation period of 28 to 36 days (Bent 1937; Schmutz 1977). Once the young have hatched, the females brood them almost constantly for the first five to seven days (Snow 1974a). The young hawks fledge at 38 to 50 days and remain near the nest for several weeks (Olendorff 1973; Eyre and Paul 1973; Howard and Powers 1973 cited in Snow 1974a). Ferruginous Hawks leave the nesting territory when the young are experienced flyers, and after some preliminary wandering when the family disperses, they migrate south late in August (Salt and Salt 1976).

TABLE 10

HABITAT UTILIZATION BY NESTING RAPTORS IN THE STUDY AREA, SUMMER, 1985

Species/Location ¹	1A ²	1A+1B	1A+2B	1A+6	2A	2B	2B+6	3	6	TOTAL
<u>Ferruginous Hawk</u>										
<u>Within Reservoir</u>										
Crowsnest River					1					1
<u>Outside Reservoir³</u>										
Oldman River	1								1	2
TOTAL (% TOTAL)	1(33)				1(33)				1(33)	3
<u>Prairie Falcon</u>										
<u>Within Reservoir</u>										
Oldman River	2		1			1				3
Castle River										1
<u>Outside Reservoir</u>										
Oldman River	4						1			4
Castle River										1
TOTAL (% TOTAL)	6(66)		1(11)			1(11)	1(11)			9
<u>Red-tailed Hawk</u>										
<u>Within Reservoir</u>										
Crowsnest River				1						1
Oldman River					2	1		3	2	8
Castle River							1			2
<u>Outside Reservoir</u>										
Crowsnest River								1		1
TOTAL (% TOTAL)	1(8)			1(8)	2(17)	1(8)	1(8)	4(33)	2(17)	12

continued

Table 10 (concluded)

Species/Location ¹	1A ²	1A+1B	1A+2B	1A+6	2A	2B	2B+6	3	6	TOTAL
<u>American Kestrel</u>										
<u>Within Reservoir</u>										
Crowsnest River	1									1
Oldman River	1							2		3
Castle River								2		2
Outside Reservoir								1		1
Castle River										
TOTAL (% TOTAL)	2(29)							5(71)		7
<u>Unoccupied Stick Nest</u>										
<u>Within Reservoir</u>										
Crowsnest River	4	1	2					1		1
Oldman River								2	1	10
TOTAL (% TOTAL)	4(36)	1(9)	2(18)					3(27)	1(9)	11

¹ Locations of individual nest sites are illustrated in Figure 3, Appendix III, and in Appendix VIII.

² Vegetation types as described in Table 2 and Reid et al. (1985).

³ Above reservoir F.S.L., upstream of the proposed reservoir in the designated buffer zones and downstream, in the area between the proposed dam site and the L.N.I.D. weir.

4.7.2.2 Habitat Preferences

Ferruginous Hawks prefer the prairie areas of Canada and western United States (Salt and Salt 1976). These birds typically nest in trees but in badland or treeless areas, nesting occurs on cliffs, buttes and cutbanks (Bent 1937; Olendorff 1973). Schumtz (1982) noted that of the 48 nests of Ferruginous Hawks in Southern Alberta, 35 were located in trees, including one on a windmill and one on an artificial nest site. He also found that most ground nests were on a cutbank of varying steepness. The availability of trees and large shrubs capable of supporting nests is an important factor in assessing the suitability of areas for nesting birds (Jasikoff 1982). As this bird also nests on the ground, areas with rolling terrain or other topographic relief such as cliffs are considered to be preferable over flat areas with little relief (op. cit.). Nest diameter of ground nests may be from less than 1 m to as large as 3 m (Weston 1969; Howard and Powers 1973). Tree nests may be from 1 m in diameter and 0.5 m deep to over 1.3 m in diameter and depth (Weston 1969). Ferruginous Hawks will reuse old nests to some degree. Smith and Murphy (1973) indicated that the Ferruginous Hawks in their Utah study area selected a different nesting site 75 percent of the time, but remained in the same locality for successive years 77 percent of the time. In contrast, Bowles and Decker (1931) indicated that Ferruginous Hawks in Washington usually used old nests and rarely built a new one.

Nests are generally located either in or within a short distance of grassland (Lokemoen and Duebbert 1976; Olendorff 1973; Gaines and Kohn 1982). Schmutz (1982) suggested that within Alberta, the expansion of cultivated lands has resulted in the Ferruginous Hawk being relegated to nest in grassland areas which have marginal potential for cultivation. Ferruginous Hawk densities in Alberta are more than twice as high in areas with soils of poor quality for crop production than in areas with soils suitable for sustaining crops (op. cit.).

Schumtz (1977) described the home ranges of Ferruginous Hawks in his Alberta study area to be in the order of 5.2 km² to 6.5 km².

Territorial disputes or actual aggressive behavior between Ferruginous, Swainson's and Red-tailed hawks were rarely observed (op. cit.). Call (1978) states that the average territory size is 2.6 to 7.7 km², with hunting forays of nine adults on the Utah-Idaho border being less than 0.8 km from the nest site. Home-range diameters averaged from 3.2 to 3.4 km, with minimum and maximum diameter of 2.4 km and 4.2 km, respectively. Houston (1982) found a ratio of 1 pair per 10.6 to 15.9 km² pm on his Kindersley, Saskatchewan study area.

Habitats with herbaceous and shrub vegetation ranging in height from 15 to 60 cm provide optimal conditions for prey abundance and also allow good hunting success by Ferruginous Hawks (Jasikoff 1982). The best habitat from a food suitability perspective contains a high quality food resource over 75 percent of that habitat (op. cit.).

All Ferruginous Hawk nests in the Study Area were located in trees and were within either vegetation type 1A (the nest site within the proposed reservoir) or in type 2A, in the case of nests upstream and downstream of the reservoir (Table 10; Reid et al. 1985). As described above, Ferruginous Hawks will nest in virtually any kind of tree or shrub capable of supporting their nests. Given the abundance of suitable nesting locations, the availability of an adequate food resource is therefore probably the principal factor affecting the location of the nest sites. In all three cases, extensive tracts of grassland (vegetation type 1A) were adjacent to or were within a three km radius of the nest sites; these grasslands harboured vast numbers of Richardson's ground squirrels, an important prey item for Ferruginous Hawks (Schmutz 1977). In his Alberta study area, Schmutz (1977) found that Ferruginous Hawks relied primarily on Richardson's ground squirrels, with voles and mice, jackrabbits and birds accounting for the balance of food items.

4.7.3 Impact Assessment

One Ferruginous Hawk nest site would be inundated by the proposed reservoir. There appears to be no shortage of trees adjacent to the reser-

voir which would be suitable for new Ferruginous Hawk nest sites. Furthermore, this species' ability to nest on cliff faces may allow this bird to exploit the slumping shorelines of the new reservoir for nest sites. Of more importance to these birds is the availability of a food source in close proximity (within an approximately three km radius) to nest sites. Grassland areas which provide numerous potential prey items such as ground squirrels are in abundance throughout the Study Area, particularly above the F.S.L. of the reservoir (Table 2). This being the case, it is likely that Ferruginous Hawks will continue to breed on or near the proposed reservoir assuming human activities do not result in excessive disturbance of nesting birds.

The Ferruginous Hawk is sensitive to human disturbance. Snow (1974a), Fyfe and Olendorff (1976) and Jasikoff (1982) have reported that these birds are prone to abandoning nests during the earliest stages of nesting through the incubation period. Once the young have hatched, the likelihood of nest desertion is, however, greatly reduced. As further evidence of this sensitivity, Schmutz (1982) discovered that only three percent of Ferruginous Hawk nests were located within 0.5 km of occupied dwellings. The potential for disturbance and subsequent loss of production therefore exists where construction-related activities might be in close proximity to Ferruginous Hawk nest sites during spring. Activity at the proposed dam site has the potential for affecting a Ferruginous Hawk nest, immediately downstream of the proposed dam site (Figure 3G in Appendix III).

4.8 MERLIN

4.8.1 Population Status

The Merlin is designated as "threatened" by Salt and Salt (1976) and COSEWIC (1985). Merlin productivity has declined dramatically due to the widespread use of pesticides over most of this species' range (Temple, pers. comm. in Trimble 1975; Hodson 1976). Alberta Energy and Natural

Resources (1984) states that Merlin populations in Alberta are stable but exact population numbers are unknown. Salt and Salt (1976) describe the Merlin as a fairly common breeding bird in all parts of Alberta, Saskatchewan, and Manitoba until mid-century. Godfrey (1966) notes the Merlin as widely distributed in summer, scarce in winter. It winters occasionally in southern Alberta (Calgary, Edmonton, Millet). Canadian Wildlife Service research with this species indicated that in some parts of southern Alberta and Saskatchewan, Merlins had vanished as a breeding bird in the 1960's and 1970's (Sadler and Myres 1976). According to Moore (pers. comm. 1983) cited by Young (1983), the estimated number of nesting pairs of Merlins within the following watersheds are as follows: Red Deer River, 150+; Bow River, 30+; Oldman River, 50+; South Saskatchewan River, 70+.

A pair of non-nesting Merlins was recorded at a location approximately 1.5 km from the proposed dam site (U. Banasch pers. comm. cited in Horejsi et al. 1978).

No Merlins were reported by landowners in the Study Area. A single Merlin was observed at the confluence of the Oldman River and Crowsnest River, and two birds were observed near the proposed dam site (Table 3 and Figure 1). The area around the dam site was searched for nests but as no nest was discovered and the birds were not territorial, it was assumed that these birds were either transients or non-breeders.

4.8.2 Life-history Description

4.8.2.1 Biology

Male Merlins arrive on breeding areas in Alberta and Saskatchewan as early as late February or early March, slightly in advance of females. Merlins use the same general area year after year for breeding but not necessarily the same actual site, particularly if young were fledged the previous year (Brown and Amadon 1968; Fox 1964).

Egg-laying commences on the Canadian prairies during the first half of May and peaks about 20 May (Fox 1964; Oliphant 1974; Hodson 1976). A clutch of 4-5 eggs is laid, with incubation requiring 29 to 31 days (Fox 1964; Hodson 1976). Hatching occurs in Alberta and Saskatchewan in early June, with the young fledging at 25-35 days (Trimble 1975).

Merlins migrate a relatively short distance into the southern Great Plains; a smaller segment of the population winters on their northern plains breeding ground (Trimble 1975). Young Merlins drift southward from Saskatchewan in mid-August (Fox 1964), with migration peaking between mid-September and mid-October in most areas. Some wintering birds seem to wander at random; others stay for some time at a location (such as an urban area) that provides abundant prey (Fox 1964; Oliphant pers. comm. in Trimble 1975).

4.8.2.2 Habitat Preferences

Godfrey (1966) describes Merlin breeding habitat as variable, consisting of open (sometimes dense) deciduous or coniferous woodland, and woodland openings and wooded prairie coulees. Hunting occurs in almost any type of country, especially outside breeding season, including marshes, beaches, mudflats and fields, often far removed from trees.

Trimble (1975) and Hodson (1976) noted that Merlins on the Saskatchewan-Alberta prairie prefer to nest in deserted farmstead shelterbelts and groves of deciduous trees where farmland has gone back to grassland. Nesting Merlins chose trees spaced well apart and which had the lower 2.4 or 3 meters rubbed bare of branches, and where undergrowth has been trampled and destroyed by cattle (op. cit.). About half of 25 nests found in Saskatchewan were within 0.8 km of water (Fox 1964). Hodson (1978) reported that all Merlins in his study area nested in clumps of poplar or Manitoba maple adjacent to shortgrass prairie. Merlins nest frequently in deserted American Crow and Black-billed Magpie nests in either deciduous or coniferous trees (Godfrey 1966). Occasionally they will nest in tree

cavities and in old Black-billed Magpie nests placed in holes in cliffs (Fyfe pers. comm. cited in Trimble 1975).

Trimble (1975) noted that wintering Merlins prefers prairie habitat with scattered trees, utility poles or other hunting perches. In northern parts of its wintering range, Merlins also frequent urban areas (Oliphant 1974); many immature birds also, for example, winter in Saskatoon, (D. Weidl, pers. comm. 1985).

The Merlin's diet is largely composed of small birds and a few flying insects such as dragonflies and grasshoppers (Salt and Salt 1976). Lawrence (1949) estimated that one breeding pair of Merlins requires 450 prey items (birds) to support themselves and their young during the 2 1/2 month nesting season. Brown and Amadon (1968) felt this is an excessively high estimate, suggesting that 3 to 5 kills a day may suffice for a female and three young. Merlins, like other raptors, will concentrate on a few prey species if these species are prone to easy capture (Trimble 1975). Hodson (1978) found that Horned Larks and Chestnut-collared Longspurs made up 87 percent of the Merlin's prey during the nesting season in Alberta.

As described above, no Merlin nests were discovered although the Study Area does provide apparently suitable breeding habitat. The Merlins observed were encountered within floodplain forest areas (vegetation type 3) and this habitat, plus Douglas fir (Type 6) provide in excess of 420 ha of potential nesting habitat which is widely available throughout the Study Area (Table 2). The variety of habitats in the river valleys and adjacent uplands also harbour a broad diversity of potential prey items for Merlins.

4.8.3 Impact Assessment

Merlins were not observed nesting within the proposed reservoir area in 1985. The Study Area contains apparently suitable nesting habitat in the form of trees in close association with grasslands. Trees suitable for nesting would continue to be available either above the F.S.L. of the

new reservoir or adjacent to the reservoir. Merlins prey upon birds that frequent grassland areas and large tracts of grassland are present above much of the proposed impoundment (Table 2). Ultimately, changing land-use practices such as increased cultivation may lead to a reduction in habitat capable of supporting these birds.

Merlins nesting in an urban environment can tolerate a considerable amount of human-related disturbance; for example, Merlins nest within the central core of Saskatoon. Outside of such environments, Merlins tend to aggressively defend their nests against potential predators as far as 0.8 km from their nests (Trimble 1975). Nests are generally deserted if the nest is disturbed prior to egg-laying (Bent 1938) but desertion is much less likely during incubation and brood-rearing (Fox pers. comm. cited by Trimble 1975).

4.9 PEREGRINE FALCON

4.9.1 Population Status

Three Peregrine Falcon subspecies exist in North America: Falco peregrinus anatum, Falco peregrinus tundrius, and Falco peregrinus pealei of which only the former two would occur in Alberta. The sub-species anatum represents the birds breeding in Alberta while tundrius migrates through Alberta to and from Arctic breeding areas. The subspecies anatum, tundrius, pealei have been designated as endangered, threatened and rare respectively by COSEWIC (1985). Salt and Salt (1976) note that the Peregrine Falcon was once abundant in Alberta but now only nests in the northern part of the province. With the wide-scale introduction of chemical biocides numbers rapidly declined. Godfrey (1966) describes the Peregrine Falcon as breeding in Alberta at Athabasca Lake, Athabasca District, Rosebud River, Red Deer River and Brooks regions. Currently about nine pairs breed in the wild in Alberta (Alberta Energy and Natural Resources 1984).

Peregrine Falcons historically nested in an area near the western end of the reservoir site along the Crowsnest River (D. Moore, pers. comm.

1985). This area is considered significant since it is known to offer potential nesting sites should the Peregrine Falcons begin nesting in the area again. No Peregrine Falcons were observed during the course of this study and D. Moore (pers. comm. 1985) indicated that this species has not inhabited this historical nesting site in the Study Area for many years.

4.9.2 Life-history Description

4.9.2.1 Biology

A. Wisely (pers. comm. 1985) reported that egg-laying usually takes place from the first week of May to mid-May in Calgary. The clutch size is from 3-6 eggs, with an incubation period of 30-35 days for each egg; eggs are incubated by both sexes (Salt and Salt 1976; Snow 1972; A. Wisely, pers. comm. 1985). Young birds fledge approximately six weeks after hatching in mid-June (A. Wisely, pers. comm. 1985).

4.9.2.2 Habitat Preferences

During breeding season, Peregrine Falcons frequent cliffs and adjacent country, both coastal and inland. During all seasons, more open country is preferred, particularly shores and marshes frequented by shore-birds and waterfowl (Godfrey 1966). Birds nest occasionally in office towers in cities such as Calgary and Edmonton (D. Moore, A. Wisely, pers. comms. 1985). Salt and Salt (1976) note that Peregrine Falcons formerly nested on the cliffs bordering the North and South Saskatchewan drainage systems, sometimes in close proximity to nesting Prairie Falcons. They have also been known to nest occasionally on slopes and river banks, mounds, sand dunes, flat bogs and plains, and sometimes in hollows of old and very large trees (Snow 1972). Favoured cliffs are often extremely high, frequently overlooking water and permitting an extensive view of the surrounding countryside (Hickey 1942). Mindell (1983) notes that in Alaska, actual nest heights ranged from 7 m to 54 m above river level.

Snow (1972) reports Peregrine Falcons nest in cliffs within igneous and sedimentary rock formations. A big hole, wide slit, or recess seems to be used more often than a broad ledge, buttress or shelf, and nesting pairs occasionally use a basin-like formation lying between a pillar or pinnacle and the main cliff. The number of different nesting ledges used by a single pair over a long period of years may vary from usually one or two to as many as seven. The maximum distance between alternative cliffs in different years may exceed six km.

The Peregrine Falcon's principal food items are passerine birds, waterfowl and shorebirds (Snow 1972; Mindell 1983). Wetland or riverine habitats provide the greatest hunting opportunities due to the densities and diversity of prey items.

The Study Area contains numerous cliff faces which would be suitable for nesting Peregrine Falcons. Such cliff faces fall within the vegetation type 2B (Reid et al. 1985); approximately 96 ha of this vegetation type are present within the proposed reservoir, of which only a small proportion would consist of cliffs which would be suitable for nest sites (Table 2).

4.9.3 Impact Assessment

Although Peregrine Falcons historically nested within the proposed reservoir, they have not done so for many years (D. Moore, pers. comm. 1985). Their last known nesting location would be inundated by the proposed reservoir. Apparently suitable cliff-nesting habitat does, however, exist upstream and downstream of the proposed reservoir as well as above the reservoir F.S.L. (Table 11). Peregrine Falcons have been successfully reintroduced into a variety of locations in Alberta (D. Moore, pers. comm. 1985) and should this strategy be considered at some stage, potential nesting habitat will continue to exist in the vicinity of the reservoir.

TABLE 11

ESTIMATE OF THE AMOUNT OF POTENTIAL CLIFF-NESTING RAPTOR HABITAT
ABOVE THE RESERVOIR F.S.L., IN THE BUFFER ZONES OF THE STUDY AREA
AND IN THE AREA BETWEEN THE PROPOSED DAM SITE AND THE L.N.I.D. WEIR,
SUMMER, 1985

Location	Potential Cliff-nesting Raptor Habitat (m of cliff) ¹
Above F.S.L.	200
Crowsnest River Buffer	0
Oldman River Buffer	300
Castle River Buffer	100
Dam to L.N.I.D. Weir	480
TOTAL	1080

¹ Values based on visual estimates of horizontal lengths of
potential cliff-faces only.

The reaction of Peregrine Falcons to human activity varies considerably. Human harrassment during the early stages of reproductive activities can cause birds to abandon breeding activity (Snow 1972; Fyfe and Olendorff 1976). Nonetheless, the presence of successfully nesting Peregrine Falcons within urban environments such as Calgary and Edmonton is indicative of this species' tolerance of at least indirect human activities (D. Moore, A. Wisely, pers. comm. 1985).

4.10 PRAIRIE FALCON

4.10.1 Population Status

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC 1985) has designated the status of the Prairie Falcon as not in any category (N.I.A.C.). This N.I.A.C. rating indicates that, although the species is not classified as rare, threatened or endangered, concern over its future status exists. The total population of Prairie Falcons in the United States and Canada was estimated to be on the order of 2 000 to 2 500 pairs in the mid 1970's (Enderson, pers. comm. cited in Snow 1974b). Estimates of the number of nesting pairs of Prairie Falcons within the following mainstem rivers in Alberta in the early 1980's were: Red Deer 50+, Bow 60+, Oldman 25+, South Saskatchewan 80+, (Moore, pers. comm. 1983 cited in Young 1983).

Prairie Falcons have historically utilized portions of the Study Area as breeding areas. D. Moore (pers. comm. 1985) described the locations of seven Prairie Falcon eyries (nest sites) close to the proposed reservoir; three of these would be inundated by the reservoir, one is located near the proposed dam site and three are in excess of one km from the reservoir.

During this study, four active Prairie Falcon eyries were encountered within the proposed reservoir boundaries; two other active nests were immediately downstream of the reservoir, a third was upstream of the reservoir, the fourth was above the F.S.L. of the reservoir on the Castle River,

and the fifth was above the Oldman River valley, less than two km south of the proposed dam site (Tables 3 and 10; Figure 3F in Appendix III). The resident population of Prairie Falcons within the proposed reservoir was four pairs plus a minimum of three young in 1985 (Table 3).

4.10.2 Life-history Description

4.10.2.1 Biology

Prairie Falcon pairs usually arrive on eyries in March, with courtship lasting approximately one month (Snow 1974b). Pairs of Prairie Falcons were at nesting ledges on the Oldman River as early as 4 March, 1986 (D. Young, pers. obs. 1986). In the Calgary region, pairs have been observed at nest sites as early as 14 March in some years (Sadler and Myres 1976). Either the male or the female may arrive at the eyrie first (Enderson 1964; Brown and Amadon 1968; Webster 1944).

Three to six eggs are laid on bare rock, in a scrape or in the nest of other birds, with preference for shallow cavities or ledges protected by an overhang (Godfrey 1966; Ogden and Hornocker 1977). The period of incubation may vary from 29 to 33 days. The young hatch over a period of two to three days, indicating that incubation does not begin with the laying of the first eggs (Enderson 1964; Webster 1944; Williams and Matteson 1947). If the first clutch of eggs is lost, Prairie Falcons frequently lay a second clutch within 20-25 days (Bent 1938; Tyler 1973). The female does most of the incubation although males have been observed to incubate while the female consumed prey (Snow 1974b).

The fledgling period is about 40 days long, with fairly high fledging success. Ogden and Hornocker (1977) reported an average clutch size of 4.3 eggs in Idaho and a fledging success of 3.1 young per eyrie. Olendorff (1973) noted an average clutch size of 4.42 and a fledging success of 3.42 per eyrie on the Pawnee National Grasslands in Colorado.

The Prairie Falcon family group does not stay together long and the young scatter individually on pre-migratory excursions that may take them several hundred km in any direction (Salt and Salt 1976). Prairie Falcons winter from southwestern Canada to Central Mexico (Godfrey 1966), with some wintering in the vicinity of their eyries (Salt and Salt 1976). Snow (1974b) reported concentrations of adult and juvenile birds occur on the plains during winter. Juveniles wander more than adults, with the latter establishing winter territories. D. Young (pers. comm. 1985) has observed adult Prairie Falcons along the Milk River in southern Alberta during mid-winter.

4.10.2.2 Habitat Preferences

Prairie Falcon habitat includes typically dry open country, in the vicinity of cliffs, canyons, coulees, badlands, and rock outcrops, with grasslands providing hunting areas (Godfrey 1966). The high clay cliffs bordering prairie creeks and rivers provide suitable sites for the eyries of the Prairie Falcon (Salt and Salt 1976). Suitable cliffs may range in height from low rock outcrops of 10 m to vertical, 120 m high cliffs (Snow 1974b). The ideal cliff has a sheltered ledge with gravel or loose material from which the falcon makes a "scrape" or nest depression and the site overlooks at least some treeless country for hunting. Sousa (1981) suggested that any cliff (>9 m high and >30.5 m in length) has the potential for supporting nesting Prairie Falcons unless the cliff contains no potential nesting sites or if significant human disturbance (e.g., agricultural activities, roads) occurs within one km of nest sites.

Of 36 nesting cliffs which Enderson (1964) examined in Colorado and Wyoming, 14 were within sandstone, 10 were within sedimentary conglomerate, 7 were within limestone and 5 were within granite formations. In that study the majority of nesting ledges faced south. Ogden and Hornocker (1977) reported no preference for aspect (direction of exposure) for Prairie Falcon nests in Idaho.

Falcons usually have alternative nesting sites located on the same cliff (Call 1978). Nesting failure does not seem to deter use of the

cliff in the following year (Snow 1974b). Banding returns from Enderson's (1964) Wyoming-Colorado study indicated that only slightly more than 50 percent of the individual nesting falcons returned to the site used in the previous year.

Prairie Falcons have large home ranges, often as large as 121 km² (Bureau of Land Management 1979 in Sousa 1981). These ranges may vary in shape but if they are considered as circular, they would encompass a circle with a radius of approximately 6 km (op. cit.; Banasch 1976).

Data on densities of Prairie Falcons is scarce. Webster (1944) described an area in Colorado with a density of 23 pairs along 26 km of cliffs. Ogden and Hornocker (1977) reported a density of 101 pairs on a 72 km stretch of the Snake River in Idaho, with 80 percent of nest sites 1.6 km apart. Olendorff (1973) reported a density of 1.4 pairs of Prairie Falcons per 259 km² on the Pawnee National Grasslands, northeastern Colorado.

The best foraging habitats for Prairie Falcons are those with low densities of shrubby vegetation, essentially treeless, with densities of herbaceous vegetation of at least 20 percent; under such conditions, prey are abundant yet can be hunted with success by Prairie Falcons (Sousa 1981). Bond (1936) noted that Prairie Falcons tend to have definite hunting ranges. When food is plentiful their hunting areas are confined to the smallest area necessary to secure required food supplies. Sousa (1981) noted that Prairie Falcons require a minimum of 6 km² of potential foraging habitat within suitable cover types which tend to be open grassland and shrub communities. Prairie Falcons presumably concentrate their hunting efforts on portions of their home range that can most efficiently provide their energetic requirements (op. cit.). Sousa (1981) also concluded that energetic costs of hunting are approximately equal anywhere within a 6.2 km radius of nest sites. Beyond this radius, the value of the prey item decreases because of additional energy expenditures (op. cit.). In southern Alberta, this species generally hunts in grassland areas within six km of nest sites (Banasch 1976). Sousa (1981) also concluded that an area containing in excess of 75 percent optimal habitat (i.e., food suitability

- prey conditions) would provide optimal prey availability for Prairie Falcons.

Prairie Falcons select prey based upon locality, season and the hunting abilities of the individual falcons (Bent 1938). Prairie Falcons primarily feed on small mammals, particularly ground squirrels, although insects and small to medium-sized birds are also taken (Salt and Salt 1976; Ogden and Hornocker 1977). The Horned Lark is the main winter food item for Prairie Falcons in winter wheat areas (Snow 1974b).

The majority of Prairie Falcon nest sites was located within vegetation type 1A (Table 10). Within this vegetation type, nest sites were located on steeply sloping cliff faces. Due to the vertical configuration of the cliffs, delineation of cliff faces alone within this grassland-dominated habitat was difficult with 1:25 000 scale photographs (D. Reid, pers. comm. 1985). The grassland vegetation that characterizes this vegetation type provides suitable habitat for the prey species, principally Richardson's ground squirrels, that Prairie Falcons prey upon. This vegetation type occurs around all of the nest sites comprising approximately 57 percent of the habitat within the proposed reservoir and approximately 46 percent of the habitat adjacent to the proposed reservoir (Table 2).

4.10.3 Impact Assessment

Prairie Falcons nested throughout the Study Area, with four active nest sites located below the F.S.L. of the proposed reservoir. These breeding birds will be displaced from existing nesting locations; the extent to which alternative habitat can accommodate these birds is unknown. Potential cliff-nesting habitat, which was not utilized in 1985, exists above F.S.L. as well as upstream and downstream of the proposed reservoir (Table 11). Nonetheless, other nesting Prairie Falcons occupy cliff faces on the Oldman River, immediately upstream and downstream of the proposed reservoir (Figures 3C and 3G in Appendix III). Prairie Falcons may colonize cliff-faces above the reservoir, and the slumping shorelines

of the reservoir may create new nest sites (R. Fyfe, pers. comm. cited in Westworth 1985). Assuming that sufficient nest sites are available, Prairie Falcons will continue to frequent the reservoir area providing grasslands upon which they rely for feeding are present in abundance above the river valleys and within a six km radius of nest sites.

Nesting Prairie Falcons are susceptible to nest desertion and loss of production during the early stages of egg-laying (Fyfe and Olen-dorff 1976). The likelihood of nest desertion does, however, decrease as incubation proceeds, particularly as hatching approaches (op. cit.). Disturbance at the nest site may also cause egg breakage or loss of eggs and young when adult birds are startled and leave the nest quickly (op. cit.). The Prairie Falcon eyries in close proximity to the proposed dam site (Figure 3G in Appendix III) could be susceptible to disturbance associated with project-related activities.

4.11 BURROWING OWL

4.11.1 Population Status

The Burrowing Owl has been designated as a "threatened" species (COSEWIC 1985). The estimated number of nesting pairs for various watershed in southern Alberta in the mid-1970's were as follows: Red Deer River, 214; Bow River, 51; Oldman River, 118; South Saskatchewan River, 160; (Wedgwood 1978 cited in Young 1983). Wedgwood (1978) approximated the total population of western Canada as about 2 000 pairs, made up of 110 pairs in Manitoba, 1 280 pairs in Saskatchewan, 610 pairs in Alberta and no confirmed pairs in British Columbia. Godfrey (1966) describes the Burrowing Owl as breeding in southern interior British Columbia, southern Alberta (southern plains to about Red Deer Lake), southern Saskatchewan and southwestern and central-southern Manitoba.

Burrowing Owls may occur in the Study Area, but most of the records for these species are located east of Fort Mcleod (Wedgwood 1978).

Local landowners described seeing Burrowing Owls in previous years but no one observed birds in 1985. No Burrowing Owls were observed during the course of this study.

4.11.2 Life-history Description

4.11.2.1 Biology

Wedgwood (1978) described that birds in Western Canada are migratory, with spring arrival dates of 30 March - 18 April and fall departure dates of 4 October - 20 October. Possible flocking during migration is also suggested (op. cit.). According to Zarn (1974), females lay eggs from late March to early May, usually during the latter part of this period. A clutch of 6-10 eggs is laid (Godfrey 1966), with incubation lasting about four weeks (Zarn 1974). The young emerge to stand at the burrow entrance and wait for the parents to bring them food when they are about two weeks of age (Zarn 1974). They begin to fly at about four weeks and at six weeks, can fly quite well but remain within 50 m of the burrow. As the young mature, they begin to accompany the parents on foraging flights and by September, pairs, families and colonies begin to disperse (Zarn 1974).

4.11.2.2 Habitat Preferences

Burrowing Owls in North America breed from southern Manitoba and British Columbia south to Florida and Panama, and winter from southeastern United States to southern South America and occasionally in southern British Columbia (Salt and Salt 1976). In Canada, these birds prefer dry, open, treeless country (Godfrey 1966). Wedgwood (1978) described that birds prefer open prairie sites containing potential nest burrows in the form of abandoned burrowing mammal dens; these dens would preferably be located within closely cropped grasslands. Konrad and Gilmer (1984) described nesting burrows in North Dakota as typically having platforms of

fine, packed soil at the entrances, and burrow entrances carpeted with shredded cow manure. Martin (1973) also notes that the nest chamber floor is lined approximately 2.5-cm deep with shredded feces; the lining possibly provides insulation, but may also serve to camouflage the owls scent, and possibly that of its prey, from predators such as badgers, coyotes and snakes.

Coulombe (1971) found that pair bonds were strong but territoriality was not. Territory size varies in colonies, with a mean of 2.4 ha and spacing between nest burrows as small as 18 m (Thomsen 1971). Martin (1973) found considerably larger territories in his study, with spacing between neighbours averaging 166 meters. Butts (1969) found that twice as many territorial conflicts occurred in an area with one nest per 0.7 ha. Breeding densities of Burrowing Owls in California ranged from one per 2.5 ha on the Oakland Municipal Airport (Hennings 1970) to one per 20 ha along a census route in Imperial Valley (Coulombe 1971).

The Burrowing Owl consumes mostly insects and small mammals (Zarn 1974). Butts (1969) found that arthropods occurred in 90 percent of the owl pellets in spring. Grasshoppers were the most important prey item of owls in summer and fall (James and Seabloom 1968). Konrad and Gilmer (1984) found that meadow voles were the most important prey species in central North Dakota, with other prey species including passerine birds, a small plains garter snake, northern leopard frogs and insects. Food availability may determine the relative frequency of occurrence of food items in owl pellets (Errington and Bennett 1935; Glover 1953).

Burrowing Owls will fly as far as 1.6 km to obtain food items (Hamilton 1941) and owls apparently ranged at least one km from their burrow to foraging grounds in California (Hennings 1970). Butts (1969) observed the radii of home ranges of adults in spring and summer to be less than 25 km. He further states that foraging trips of 100 to 300 m in early morning and late evening, were common when adult males were feeding young.

Landowners in the Study Area described that Burrowing Owls were more commonly encountered in upland rather than valley areas, and that these birds were also observed in cultivated fields and pasture lands. Grassland areas (principally vegetation type 1A) would provide preferred habitat for this species because of the presence of burrowing mammal dens in such areas. Grassland areas occur in greater amounts in areas above the F.S.L. of the proposed reservoir (Table 2).

4.11.3 Impact Assessment

Burrowing Owls were not encountered in the Study Area. As described above, previous observations of this species were in grassland and cultivated areas above the river valleys. While these types of habitat do exist within the proposed reservoir area, they are more abundant above the river valleys (Table 2). Furthermore, given the Burrowing Owls reliance upon burrowing mammals, particularly badgers for nest-burrow creation, it is more likely that owls would occur in the area above the valley where burrowing mammals are more common (see Section 4.3).

Wedgwood (1978) indicates that Burrowing Owls are quite tolerant of human activity. Through a questionnaire, he found that 17 nest burrows were close to buildings and 19 were distant. Twelve of 45 Burrowing Owl pairs in central Saskatchewan had their nest burrows within 40 m of highways and grid roads (Wedgwood 1976); 10 pairs were also located on the outskirts of towns and villages and three within city limits within the prairie provinces.

4.12 NORTHERN LEOPARD FROG

4.12.1 Population Status

The northern leopard frog has greatly declined in number since 1978 and is not present over much of its former range in south-central

Alberta; until the nature and extent of this decline is understood, this species should be regarded as threatened within Alberta (Roberts 1982). Lewin (1963) collected breeding adult leopard frogs from an oxbow and another small pond in the Milk River canyon during the latter half of May and in the first week of June 1961-62. Cook (1985) described capturing northern leopard frogs four km north of Waterton National Park and in the vicinity of Lethbridge and Cardston in 1957.

No observations of northern leopard frogs were reported by landowners in the Study Area or by investigators conducting this study.

4.12.2 Life-history Description

4.12.2.1 Biology

The leopard frog is usually one of the first frog species to emerge from hibernation in the spring, with breeding taking place in late April and May (Dickerson 1908; Saskatchewan Department of Natural Resources 1966). Masses of eggs, numbering from 3 500 to 4 500 are often attached to sticks or stems of aquatic plants, or left lying free on the waterbody substrate in shallow water (Froom 1982). Development begins within two or three hours after the eggs are laid, with tadpoles emerging out of the eggs and development into adults occurring from late June to August (Saskatchewan Department of Natural Resources 1966). Cook (1984) explains that adults generally return to ponds and rivers where they usually remain more-or-less dormant on the bottom in winter.

4.12.2.2 Habitat Preferences

Northern leopard frogs are found throughout most of North America (Carl 1966; Preston 1982). They prefer shallow water with aquatic vegetation or closer to shore, where sedges, grasses and willow grow (Dickerson 1908). In dry years, adults tend to remain concentrated where there

is water but if sufficient moisture is available, they move into neighbouring fields and pastures (Saskatchewan Department of Natural Resources 1966). Stebbins (1954) also reports that they may be found in irrigation canals. Hopkins (1983) described that northern leopard frogs were encountered along streams but that they were much more common around wetlands in North Dakota. Cook (1985) reported capturing northern leopard frogs in sloughs, beaver ponds and ditch puddles in Waterton National Park.

Tadpoles feed on waterweeds or algae from stones and sticks at the bottom of waterbodies (Dickerson 1908). The adults feed on a variety of terrestrial arthropods (Saskatchewan Department of Natural Resources 1966).

Due to the paucity of standing water in the Study Area, suitable northern leopard frog habitat is largely lacking. The oxbow marshes downstream of the proposed reservoir in the vicinity of Brocket provide habitat most suitable for this species.

4.12.3 Impact Assessment

Northern leopard frogs were not reported in nor were they encountered in the Study Area. The Study Area is notable for its paucity of wetlands and given this frog's preference for such habitat, the likelihood of this species occurring with any regularity, if at all, is considered remote.

4.13 WESTERN PAINTED TURTLE

4.13.1 Population Status

The western painted turtle is not on the COSEWIC (1985) list; however, it is listed as endangered in Alberta by Roberts (1982). Endangered is defined as a species or subspecies whose prospects for survival

and reproduction within Alberta are in immediate jeopardy. Roberts (1982) states that the only known natural breeding populations are in the lower Milk River Canyon and the Cypress Hills. Widely scattered records of individuals in central and southern Alberta may be the result of human introductions or perhaps represent very localized populations (op. cit.).

Successful introductions of this species in the Crowsnest Pass suggest the possibility of downstream movements of turtles along the Oldman River to the proposed reservoir site (Westworth 1985). Landowners in the Study Area reported observations of turtles in the rivers or creeks 10 or 20 years ago but not in recent years. Turtles are, however, evidently present in Lees Lake, a small waterbody approximately eight km south of the upper portion of the proposed reservoir (L. Allison, pers. comm. 1985). No turtles were observed during the course of 1985 field investigations.

4.13.2 Life-history Description

4.13.2.1 Biology

Western painted turtles hibernate in winter in the mud or debris of pond bottoms or in holes in banks (Stebbins 1954). Preston (1982) observed individuals resting on the bottom of a shallow, ice-covered pond in British Columbia. McAuliffe (1978) observed seasonal movements among a population of painted turtles in eastern Nebraska. He noted that after the 1975 spring thaw, turtles were first noted to be active on 19 March with emigration of turtles to outlying sloughs noticed on 26 April. The greatest migratory distance he recorded was a male that travelled over 2.1 km. From a study of turtles in the Qu'Appelle River valley of southern Saskatchewan, MacCulloch and Secoy (1983) found that with the exception of juveniles in 1979, the majority of the turtles in each sex-age group moved 500 m or more during one season. They concluded that distances travelled were variable but males travelled the farthest (1979 mean-6 km), with one male in 1979 travelling a distance of 6.5 km in one day.

Breeding occurs in spring or sometimes fall, with the eggs being laid in May, June, or July (Stebbins 1954). Usually 8-10 eggs are laid, with an incubation period of about two months (Harless and Morlock 1979; Stebbins 1954). The eggs usually hatch in fall, or eggs may overwinter with emergence in spring (Stebbins 1954). Multiple clutches are found in some parts of their range (Wisconsin, Illinois, Tennessee, Louisiana and Oklahoma); however, short growing seasons and harsh winter conditions could hamper development and survival of late clutches (Moll 1973).

4.13.2.2 Habitat Preferences

In Canada, western painted turtles occur from the region of Lake Superior westward to Vancouver Island (Pope 1967; Preston 1982). Western painted turtles prefer quiet shallow water and frequent ponds, marshes, ditches, small lakes, and streams, especially in places where there is considerable aquatic vegetation (Stebbins 1954).

Harless and Morlock (1979) state that turtles nest in nearly all kinds and textures of soils and sand. Stebbins (1954) explains that the female digs the nest, on moderately high ground, at a distance ranging from one to several hundred m from the water. Adults are active during the day-time, often sunning in groups of several to a dozen or more, on logs and on the shore of ponds and slow-flowing watercourses (Stebbins 1954). McAuliffe (1978) found the density of turtles in his study area in Nebraska was 160-333 individuals per ha.

Western painted turtles feed on both plants and animals, and displays marked scavenging tendencies (Stebbins 1954). Stebbins (1954) lists plant foods as algae, duckweed, bulrush, wild celery and water lilies, and animal foods as spiders, insects, insect larvae, earthworms, crustaceans, fish, frogs, and tadpoles. Harless and Morlock (1979) noted that painted turtles do not feed when water temperatures are below 15°C and generally become inactive at temperatures less than 10°C.

The Study Area lacks wetlands and slow-flowing water, which is the preferred habitat for western painted turtles. Furthermore, the rivers contain little partially submerged debris such as logs which could provide loafing areas for basking turtles.

4.13.3 Impact Assessment

Western painted turtles were not reported nor were they observed in the Study Area. This species has been introduced into areas with drainages contiguous with those of the Study Area and thus the potential exists for this species to occur. Nonetheless, as this species prefers standing or slow-moving water, the likelihood of such an occurrence on anything other than a casual basis is considered highly remote.

5.0 SUMMARY

5.1 INTRODUCTION

Of the original nine key species selected for investigation, the long-tailed weasel, Burrowing Owl, northern leopard frog and western painted turtle were not encountered during 1985 field studies. Canada Geese were also studied during the investigation. An eleventh species, the yellow-bellied marmot was added to the list once it became apparent that this species inhabited the Study Area. Use of the reservoir by ducks was also examined. In general terms, raptors and deer constituted the majority of observations and it is for these groups that the proposed reservoir has the greatest implications. The abundance, distribution and likely impacts for all the key species or groups are summarized below.

5.2 SPECIES-SPECIFIC DESCRIPTIONS

5.2.1 Yellow-bellied Marmot

Two colonies of yellow-bellied marmots were recorded on the Castle River, both of which would be inundated by the proposed reservoir. These animals will be displaced into surrounding areas but the likelihood of successful colonization of these areas is unknown. Their ultimate success will depend upon the availability of suitable habitat (i.e., boulder piles).

5.2.2 Long-tailed Weasel

Local landowners reported that long-tailed weasels frequent the proposed reservoir area but they do so in unknown densities. No weasels were observed during field investigations but the likelihood of encountering them was small as they are not highly visible in their brown, summer pelage (fur). This species is capable of exploiting a broad variety of

habitats including farm buildings. Even if some animals are displaced by the reservoir, suitable habitat in adjoining areas should be capable of supporting the displaced weasels.

5.2.3 Badger

Although no badgers were observed during 1985 field investigations, badger diggings were observed within ground squirrel colonies. Local landowners have observed badgers on a regular basis, with most observations from grassland areas above the river valleys. Some badgers may be displaced by reservoir creation but the numbers are anticipated to be low and the existing broad expanses of grassland habitat above the river valleys should be capable of accommodating these animals.

5.2.4 Deer

The 1985 field investigations confirmed that the Study Area constituted important summer and wintering range for mule deer. Numbers of mule deer in the proposed reservoir area during summer were estimated to be in the order of 200 animals whereas less than 15 white-tailed were encountered. Reservoir creation will result in the loss of extensive tracts of fawning habitat in particular. The potential exists for deer to occupy summer range above or beyond the reservoir. However, the remaining areas of suitable habitat above F.S.L. are small, and areas downstream and upstream of the proposed reservoir are currently occupied by other deer.

5.2.5 Canada Goose

Canada Geese nest in low densities on islands, shorelines and cliffs within the Study Area. Approximately five pairs of Canada Geese nested within the proposed reservoir area in 1985. This species is highly-adaptable and will be able to select from a variety of alternative nesting

sites either on the shorelines of the new reservoir or along the rivers upstream or downstream of the reservoir area. Some Canada Geese will likely frequent the reservoir as a staging area.

5.2.6 Ducks

Ducks frequented the Study Area in low densities, with Mallards and Common Mergansers representing the majority of the few observations. The presence of fast-flowing water and the paucity of wetlands are the chief factors contributing to this poor utilization. Some breeding ducks will frequent the reservoir while areas upstream and downstream of the reservoir will be capable of accommodating the small influx of any displaced birds. The reservoir may develop into a duck staging area of limited regional significance.

5.2.7 Ferruginous Hawk

Nesting Ferruginous Hawks frequented the proposed reservoir area (one nest) as well at two locations on the Oldman River, immediately upstream and downstream of the proposed reservoir. For all three nest sites, nests were in trees on the edge of watercourses. The presence of grasslands close to nests is an important factor in nest-site selection as Ferruginous Hawks feed largely on ground squirrels from such areas. Trees suitable for nesting sites will continue to be present either above the reservoir F.S.L. or in areas adjacent to the reservoir. The slumping shorelines of the reservoir may also provide a satisfactory substrate for nests. Given the apparent abundance of such potential nest sites, nesting locations will ultimately be determined by the presence of grasslands and the associated prey base. Ferruginous Hawks are particularly susceptible to disturbance during egg-laying and incubation. An existing nest site, approximately two km downstream of the proposed dam site could potentially be affected by construction-related activities.

5.2.8 Merlin

Three Merlins were observed during 1985 field investigations but no evidence was discovered to suggest that any nests were present. Nesting can occur within most wooded areas and while much of this type of habitat would be inundated, trees are not in short supply above the reservoir F.S.L. and upstream or downstream of the proposed reservoir.

5.2.9 Peregrine Falcon

No Peregrine Falcons were observed during 1985 investigations. A Peregrine Falcon nest site was active in the upper reaches of the proposed reservoir many years ago but has not been occupied in recent years. Suitable cliff-nesting habitat is present above the reservoir F.S.L. and upstream and downstream of the reservoir should Peregrine Falcons eventually be re-introduced to the area.

5.2.10 Prairie Falcon

The Prairie Falcon represented the most commonly observed key species within the proposed reservoir area. Four nest sites occupied in 1985 would be inundated at the proposed F.S.L. of the reservoir. Some alternative cliff-nesting habitat is present above the reservoir F.S.L. and upstream and downstream of the reservoir itself. Nonetheless, other nesting Prairie Falcons occupy cliff faces in these areas adjacent to the proposed reservoir and the unoccupied alternative habitat may or may not be capable of supporting the displaced birds. Prairie Falcons are susceptible to disturbance during the early stages of breeding activity; birds at nests in close proximity to the proposed dam site may be adversely affected by dam construction activities.

5.2.11 Burrowing Owl

Local landowners reported occasional observations of Burrowing Owls in grasslands and cultivated areas above the river valleys. No Burrowing Owls were encountered during 1985 field investigations. Given the association between Burrowing Owls and burrowing mammals in grassland areas, it is likely that Burrowing owls would be encountered above, rather than within the river valleys proposed for inundation. The Study Area represents the extreme western extent of Burrowing Owl range in Alberta and should Burrowing Owls be frequenting the Study Area, they would do so in small numbers.

5.2.12 Northern Leopard Frog

Northern leopard frogs were not encountered during field investigations, nor were any reported by local landowners. The paucity of standing water is the chief factor responsible for the absence of this species within the proposed reservoir area.

5.2.13 Western Painted Turtle

Western painted turtles were not reported nor were any observed in the Study Area. The paucity of slow-moving or standing water dictates that the occurrence of this species in the proposed reservoir area would be highly unlikely.

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7.0 ACKNOWLEDGEMENTS

The authors gratefully acknowledge the contributions of the following individuals:

J. Englert	Alberta Environment, Planning Division, Edmonton
W. Griffiths	Alberta Environment, Planning Division, Edmonton
J.B. Kemper	Alberta Environment, Planning Division, Edmonton
L. Sjojka	Alberta Environment, Planning Division, Lethbridge
R. Fyfe	Canadian Wildlife Service, Edmonton
U. Banasch	Canadian Wildlife Service, Edmonton
L. Fitch	Alberta Fish and Wildlife Division, Lethbridge
D. Moore	Alberta Fish and Wildlife Division, Edmonton
A. Wisely	Alberta Fish and Wildlife Division, Calgary
C. Bjornson	Environmental Management Associates, Calgary
D. Fernet	Environmental Management Associates, Calgary

APPENDIX I

TERMS OF REFERENCE

DATED MAY 14, 1985

OLDMAN RIVER DAM - ENVIRONMENTAL MITIGATION/OPPORTUNITIES PLAN 1985 WILDLIFE INVESTIGATIONS

OBJECTIVE

The general objective of this project is to enumerate resident and/or breeding populations of important, rare or endangered wildlife, birds, amphibians and reptiles that may be affected by the construction of the Oldman River Dam.

STUDY LOCATION

The Oldman River dam is located in the foothills of Southwestern Alberta. The attached map outlines the general location of the proposed reservoir and the location of the dam. The study will include the entire reservoir area and areas directly impacted by construction of the dam and appurtenant works. Waterfowl study will also include the river from the dam to the L.N.I.D. weir and areas adjacent to the reservoir above F.S.L.

REQUIREMENTS

1. The consultant will provide Alberta Environment with a general inventory of the important wildlife species which inhabit the reservoir area and correlate these species to their key habitat requirements. The determination of species importance shall consider the local and regional distribution of the species, its significance to local and special interest groups and its economic importance. Since separate winter surveys of ungulates have been initiated independently, only incidental observations of ungulates are required during the normal course of summer field investigations.

2. Nine species listed as rare, endangered or threatened may or may not occur within the Oldman River Dam study area. These include: badger, long-tailed weasel, Peregrine Falcon, Ferruginous Hawk, Prairie Falcon, Merlin, Burrowing Owl, northern leopard frog and western painted turtle. Using aerial surveys, walking ground surveys and landowner interviews, as appropriate, determine the following for each species:
 - a) Population status.
 - b) Important habitat areas.
 - c) Impact of reservoir development both in habitat lost and loss of prey population for predators.
3. Survey the river from dam site to the reservoir F.S.L. on the Oldman, Castle and Crowsnest Rivers to determine the amount of nesting activity and brood production by Canada geese. Determine the availability of alternate, unoccupied nest sites (including island, ledges and holes in cliffs) in adjacent areas upstream and downstream (to L.N.I.D. Weir) from the reservoir site. Identify potential sites for development or enhancement of alternative nesting habitat.
4. The distribution and habitat requirements of those species investigated under this contract shall be mapped by the consultant using the Alberta Environment vegetation false color infrared mosaic as a base. The preparation of the map overlays for the wildlife study will be the responsibility of the consultant.

APPENDIX II

HABITAT-VEGETATION TYPE DESCRIPTIONS

The following habitat descriptions have largely been derived from vegetation type descriptions as provided by Reid et al. (1985). The emphasis in habitat description within the Study Area is to provide details of the inherent components of the landscape which may be required by wildlife species. Vegetation composition and structure are therefore important in determining cover availability while the successional stage of a particular habitat type will to a large extent, determine the type and abundance of nesting and forage species available. Other biophysical components of the habitat type which may be important to particular wildlife species include slope angle, slope aspect and drainage conditions.

In addition to year-round use of preferred areas, certain wildlife species may have specific key life history habitat requirements which are met exclusively within particular habitat types; for example, winter habitat areas for ungulates or nesting sites for raptors. Within each of the following habitat type descriptions, the dominant characteristics of the type are described along with the wildlife species which are most likely to utilize it.

Western Wheat Grass - June Grass (Map Unit 1A)

This habitat type is the dominant grassland in the area and is characterized by an open community of western wheat grass and June grass as well as a few scattered low shrubs. The primary species are:

Shrubs (5%)

buckbrush

ground juniper

Herbs (15%)

pasture sagewort

broomweed

pussy-toes

Grasses (25%)

western wheat grass

June grass

needle and thread grass

This habitat type is used extensively by mule deer and raptors for foraging and in the latter case also for nesting.

Such areas occur on a large variety of landforms including lacustrine, moraine and glaciofluvial plains as well as on high terraces adjacent to the river valleys. The coarse to fine loam to clay textured materials are rapidly to well drained.

The vegetation type represents a grazing disclimax (disturbance climax due to grazing) of the regional grassland climax, rough fescue - Parry oat grass type. The wheat grass - June grass type is well suited to tolerate open south-and west-facing slopes subject to drying winds. Occasional fires burn the area arresting the invasion of shrubs and trees. Grazing by livestock is the predominant use of the grassland, and much of the level to gently sloping areas have been cultivated for grain production or improved pasture. The type covers approximately 1 435 ha or 57% of the reservoir area (Table 2).

Rough Fescue - Parry Oat Grass (Map Unit 1B)

This habitat type represents a grassland dominated by rough fescue and Parry oat grass which form distinctive bunches or tussocks, between which herbs and a few scattered shrubs are found. The primary species are:

Shrubs (10%)

shrubby cinquefoil
prairie rose
buckbrush

Herbs (20%)

rough fescue
Parry oat grass
bluebunch fescue

Grasses (30%)

blazing star
prairie crocus
prairie sagewort
sticky purple geranium

This vegetation type was frequented only to a small degree by wildlife.

The fescue-oat grass type remains on a few landforms in the area, namely lacustrine, and glaciofluvial plains as well as on higher terraces in the river valleys. The vegetation here represents the regional climax for most parts of the black soil zone and is found locally on north- and south-facing slopes on the east side of the Castle River and on a small area on the west side of the Oldman River north of the confluence with the Crowsnest River. Occasional grass fires burn the area and arrest the invasion of shrubs and trees. Grazing is the predominant use of the remaining grassland, with much of the area being converted to a grazing disclimax or cultivated for grain crop production. The fescue-oat grass type covers approximately 46 ha or 1.8% of the reservoir area (Table 2).

Saskatoon Choke Cherry (Map Unit 2A)

This type consists of open to dense clumps of shrubs 1 to 3 m high that are usually located within the western wheat grass - June grass vegetation type. The primary species are:

Shrubs (80%)

saskatoon
choke cherry
buckbrush

Herbs and Grasses (30%)

cow parsnip
kidney - leaved violet
awnless brome

Extensive shrub cover of preferred browse species such as saskatoon and choke cherry provide good browsing opportunities and protective cover for deer. Other species which utilize this habitat type include tree-nesting raptors.

This shrub type is frequently found on north- to northeast-facing, moderately to strongly-rolling slopes of morainal, glaciofluvial deposits and fluvial terraces. These cooler aspect slopes accumulate snow, which melts late in the spring, providing moisture well into the summer. The shrub communities are not only limited by climate, but are periodically severely reduced by grass fires and trampling by livestock.

The saskatoon-choke cherry covers approximately 75.9 ha or 3% of the reservoir area (Table 2).

Skunk Bush - Creeping Juniper (Map Unit 2B)

This type consists of open to scattered clumps of shrubs 0.5 to 1 m in height with occasional grasses. The primary species are:

Shrubs (35%)

skunk bush
creeping juniper

Herbs and Grasses (25%)

prickly pear cactus
pasture sagewort
western wheat grass
needle and thread grass

This vegetation type was utilized to only a small degree by deer and nesting raptors.

The skunk bush - creeping juniper type characterizes steep south- and west-facing slopes above the river courses. The soil texture is variable from coarse with sandstone boulders to clay loam. These slopes often have a terraced appearance due to soil creep. Severe drought due to wind is also a major factor limiting the vegetation cover. Livestock grazing is limited on these slopes due to steepness and low vegetation cover. The skunk bush - creeping juniper type covers approximately 96.3 ha or 3.8% of the reservoir area (Table 2).

Cottonwoods (Map Unit 3)

This vegetation type represents open to closed stands of hybrid cottonwoods ranging in height from 12 to 18 m, with numerous shrubs and some herbs. The primary species are:

Trees (40%)

cottonwoods

Shrubs (30%)

buck brush

prickly rose

saskatoon

Herbs and Grasses (45%)

awnless brome

golden bean

common dandelion

This habitat type affords the greatest cover within the reservoir area and it was widely utilized by tree-nesting raptors and deer.

The cottonwood stands occupy narrow bands along the Crowsnest and Castle rivers, and reach their largest extent along the broad floodplain of the Oldman River below the dam site. It occupies fluvial floodplains and older point bar deposits where the sandy fine loam to gravel soils are moderately well-drained except during snowmelt and periods of high precipitation. The sites are subject to annual flooding, sedimentation, erosion and ice scour, as well as occasional beaver logging. The cottonwood type is used extensively to shelter farm buildings, houses and livestock from the strong winds. As a result the understory often is trampled and heavily-grazed.

A variety of hybrid cottonwoods occur in the community type, however, narrowleaf cottonwood is the most common species colonizing the newly-exposed point bars. Between the mature cottonwood forest and the river water edge is a zone of cottonwood and willow seedlings, and a sparsely-vegetated bar of sand or gravel, both of which are included in the map unit. The cottonwood regeneration area is covered up to 60% by shrub-sized cottonwoods and sandbar willow as well as the grasses - redtop, and bluegrass. Over time, as sediment accumulates, these seedlings will grow and mature to form a cottonwood forest.

The floodplains along the Crowsnest River are often dominated by water birch, 4 to 5 m high, and occasional cottonwood, with an understory of red osier dogwood and bluegrass. The water birch type is included in the cottonwood map unit because of its small area. The cottonwoods habitat type covers approximately 367.5 ha or 14.7% of the reservoir area (Table 2).

Aspen (Map Unit 4)

This type represents small "bluffs" of aspen 4 to 13 m high that are associated with western wheat grass - June grass and saskatoon - choke cherry types. The primary species are:

Trees (65%)

aspen

Shrubs (35%)

buck brush

prickly rose

saskatoon berry

Herbs and Grasses (70%)

awnless brome

bluegrass

common dandelion

kidney-leaved violet

Deer utilized this vegetation type to only a small extent.

This type occurs on north- and east-facing slopes made up of shallow lacustrine material and moraine over bedrock. Aspen stands are quite rare in the study area due to the dry climate, and fire and grazing which prevent aspen from invading and eventually dominating the saskatoon - choke cherry type which grows in similar site conditions. Grazing by livestock has resulted in considerable trampling of the understory. The aspen type covers approximately 10.2 ha or 0.4% of the reservoir area (Table 2).

Limber Pine (Map Unit 5)

This type represents an open stand of pine, 4 m high, with a ground cover of low shrubs and grasses. The dominant tree species are limber pine and occasional Douglas fir, both of which commonly show a dwarfed and distorted appearance, with extensive killing of branches on the windward side of the crown. The primary species are:

Trees (35%)

limber pine

Douglas fir

Low Shrubs (40%)

ground juniper

creeping juniper

Herbs and Grasses (25%)

western wheat grass

needle and thread grass

June grass

The open canopy cover and high topographic position of this type apparently provided little suitable wildlife habitat.

This habitat type occurs on higher, drier south- and west-facing slopes and crests of ridges and rock outcroppings. The trees are able to survive on these exposed sites because an adequate amount of groundwater is available to the roots. The limber pine type with the western wheat grass - June grass type, form a parkland which is subject to grazing and trampling by livestock as well as occasional fires. Due to its location on the upper slopes and crests of hills, the type is not found in the reservoir area.

This type does not occur in the reservoir area itself but is present in areas immediately above the proposed reservoir (Table 2).

Douglas Fir (Map Unit 6)

This type occurs as a closed, relatively tall (9 to 16 m high) stand of Douglas fir and rare limber pine, with a sparse shrub and herb layer. The primary species are:

Trees (65%)

Douglas fir

Shrubs (10%)

saskatoon

choke cherry

buck brush

Herbs (30%)

western wheat grass

feathermoss

The relatively closed canopy coverage provides habitat suitable for nesting raptors and deer.

This vegetation type occurs on north- to northwest- or north-east-facing, moderate to steep slopes of shallow lacustrine material and moraine over bedrock. In addition to disturbances caused by grazing and fire, some of the steep slopes on the outside of river bends are subject to river undercutting and landslide type erosion. The Douglas fir type covers approximately 61.2 ha or 2.4% of the reservoir area.

Cultivated (Map Unit C)

This type represents areas of land utilized for agriculture such as grain crops, hay crops, summer fallow and improved pasture, as well as farmsteads and buildings. Wildlife species which may be expected to utilize these areas periodically include deer and occasionally Burrowing Owls and badger. Raptors also derive much of their prey base from such areas.

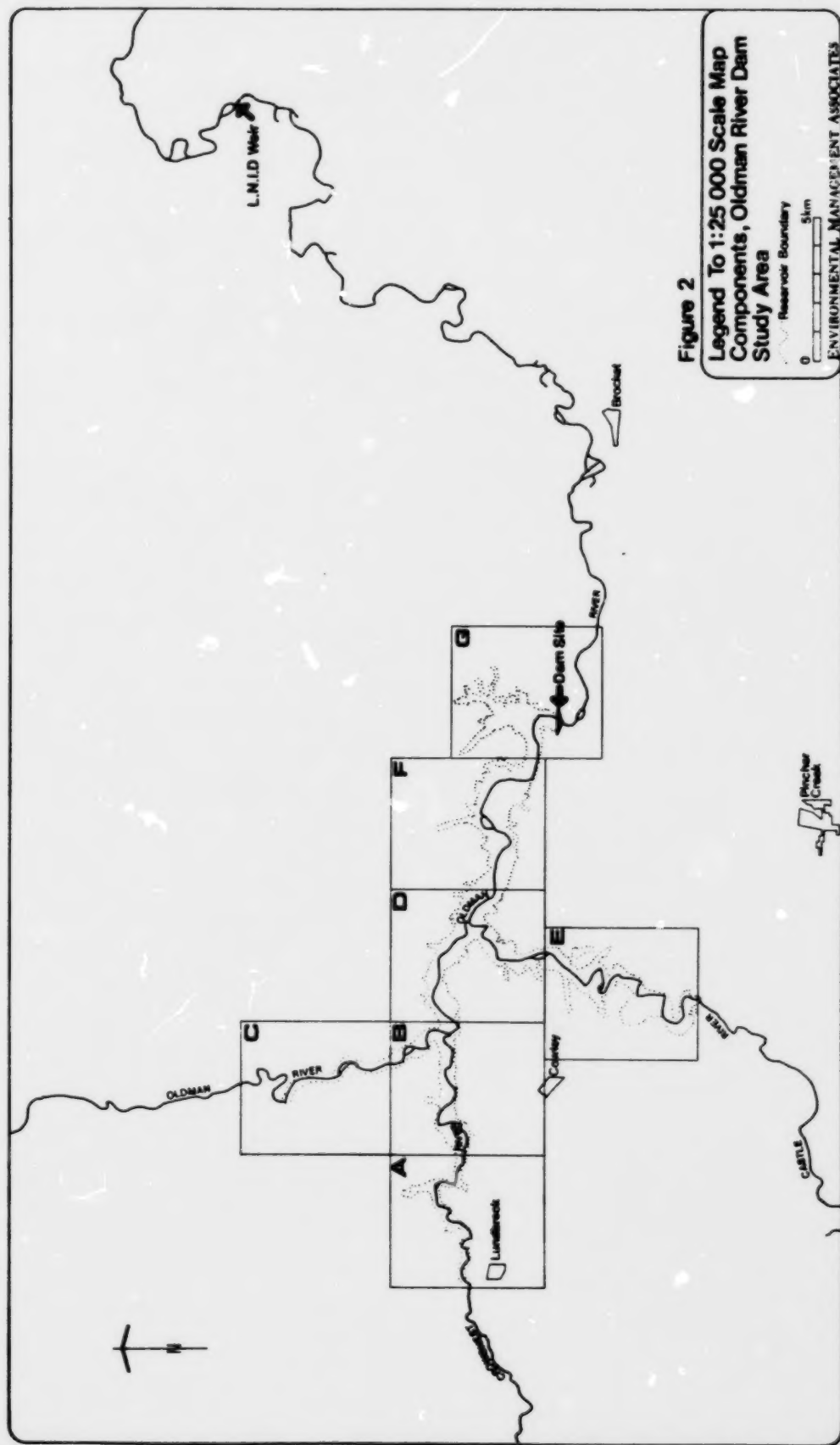
This unit occurs on level to gently-rolling lacustrine, glacio-fluvial, morainal deposits and fluvial terraces. The cultivated type covers approximately 408.4 ha or 16.3% of the reservoir area.

Gravel Pit (Map Unit GP)

Several gravel pits are located on the glaciofluvial deposits on the south side of the Oldman River west of Brocket. The pits are in various stages of development from active to abandoned. Coyotes and red foxes occasionally use such areas for den sites. This type covers approximately 6.2 ha or 0.3% of the reservoir area.

APPENDIX III

LOCATIONS OF RAPTOR NESTS AND MAMMAL DENS IN THE OLDMAN RIVER STUDY AREA



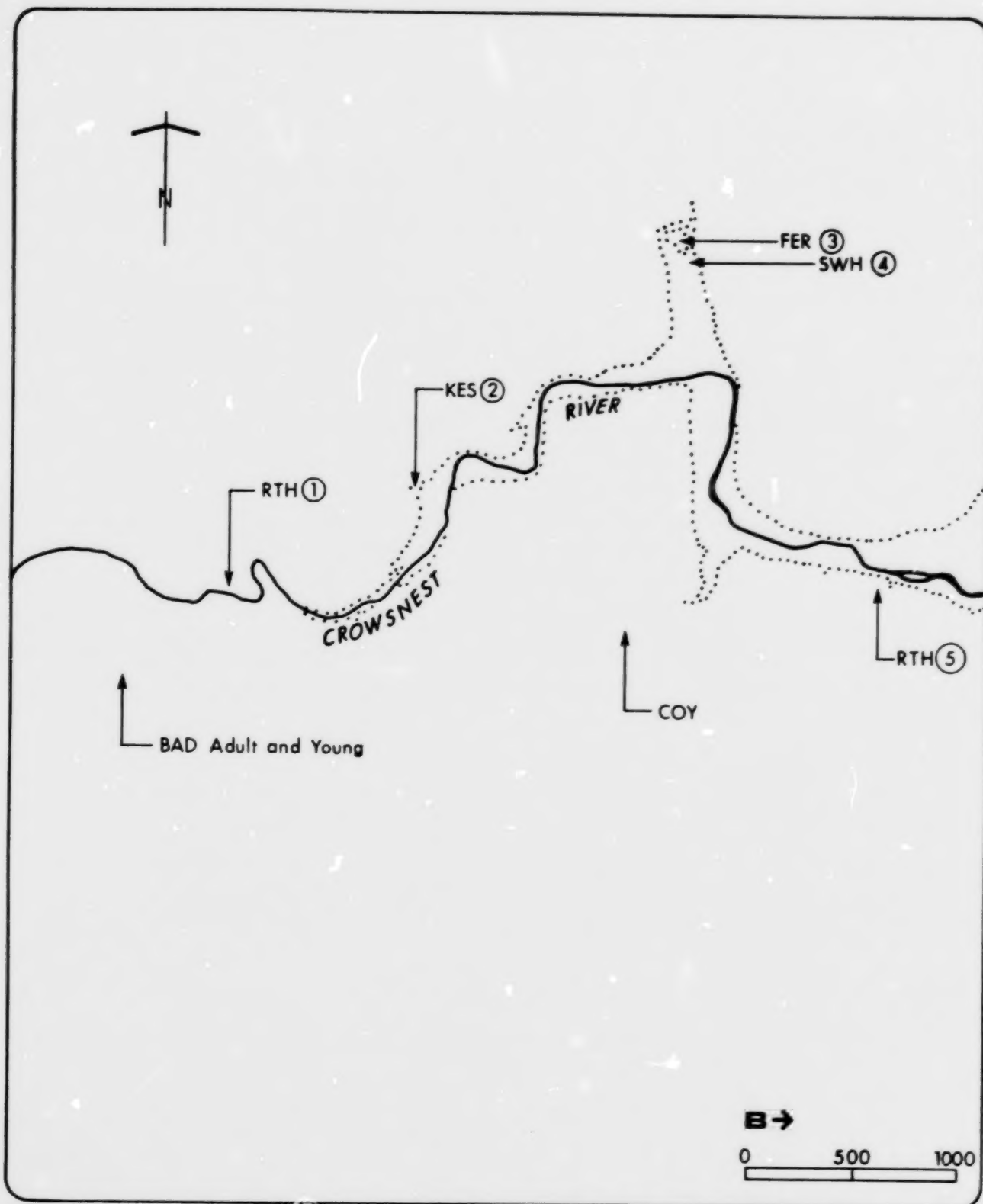


Figure 3A Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk
 KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

⑫ Observation Number

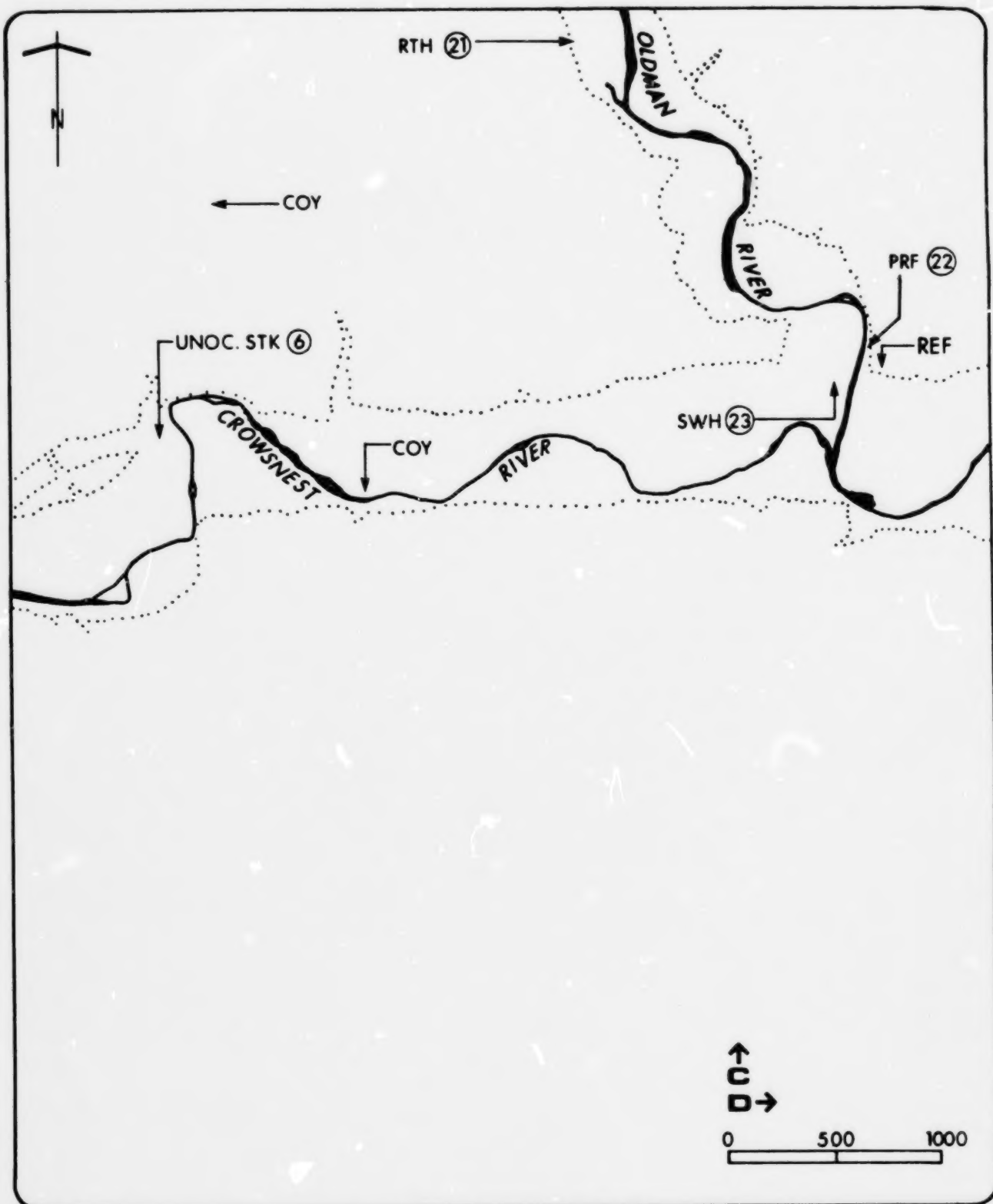


Figure 3B Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk
 KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

⑫ Observation Number

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

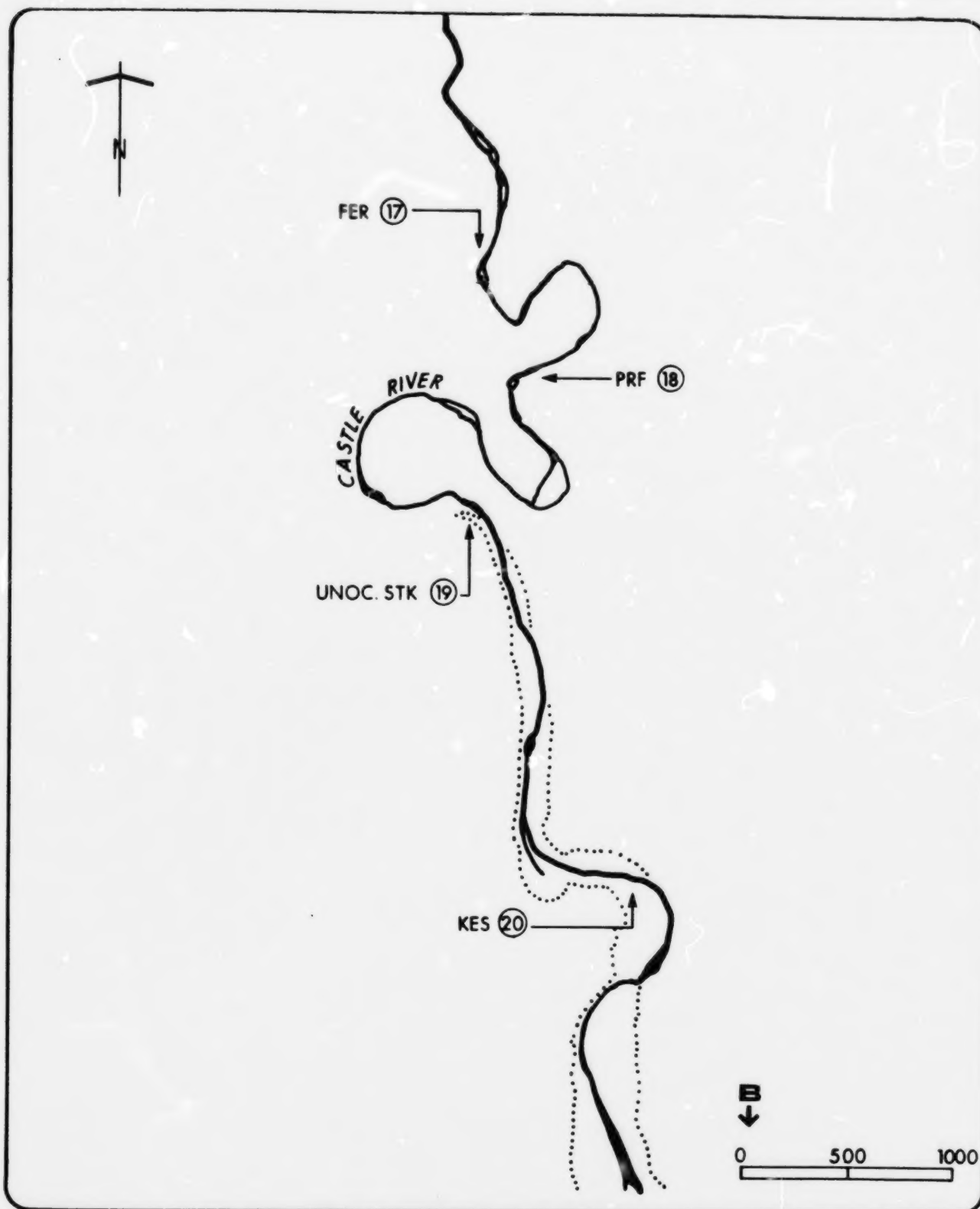


Figure 3C Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk

KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

⑫ Observation Number

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

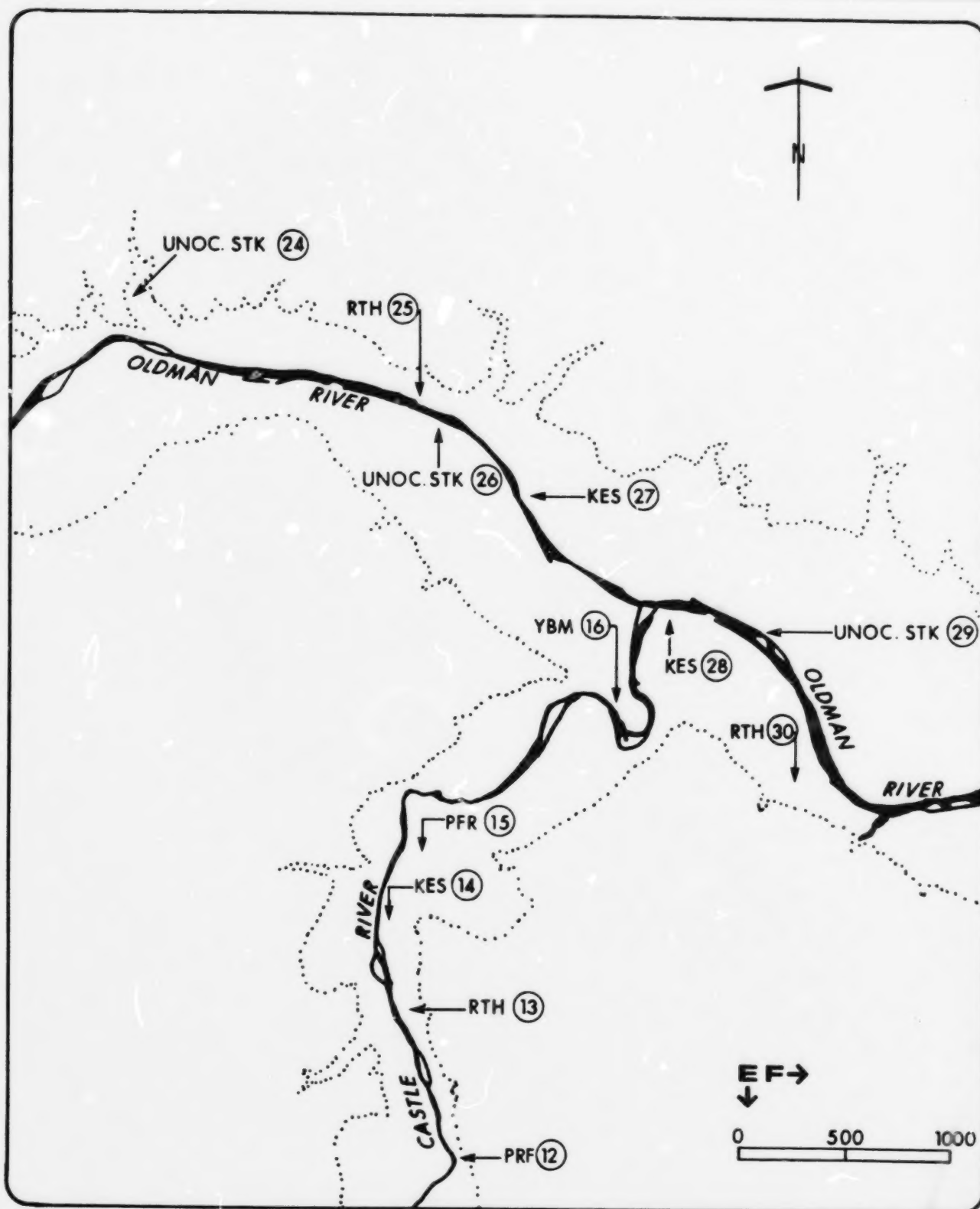


Figure 3D Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk

KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

⑫ Observation Number

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

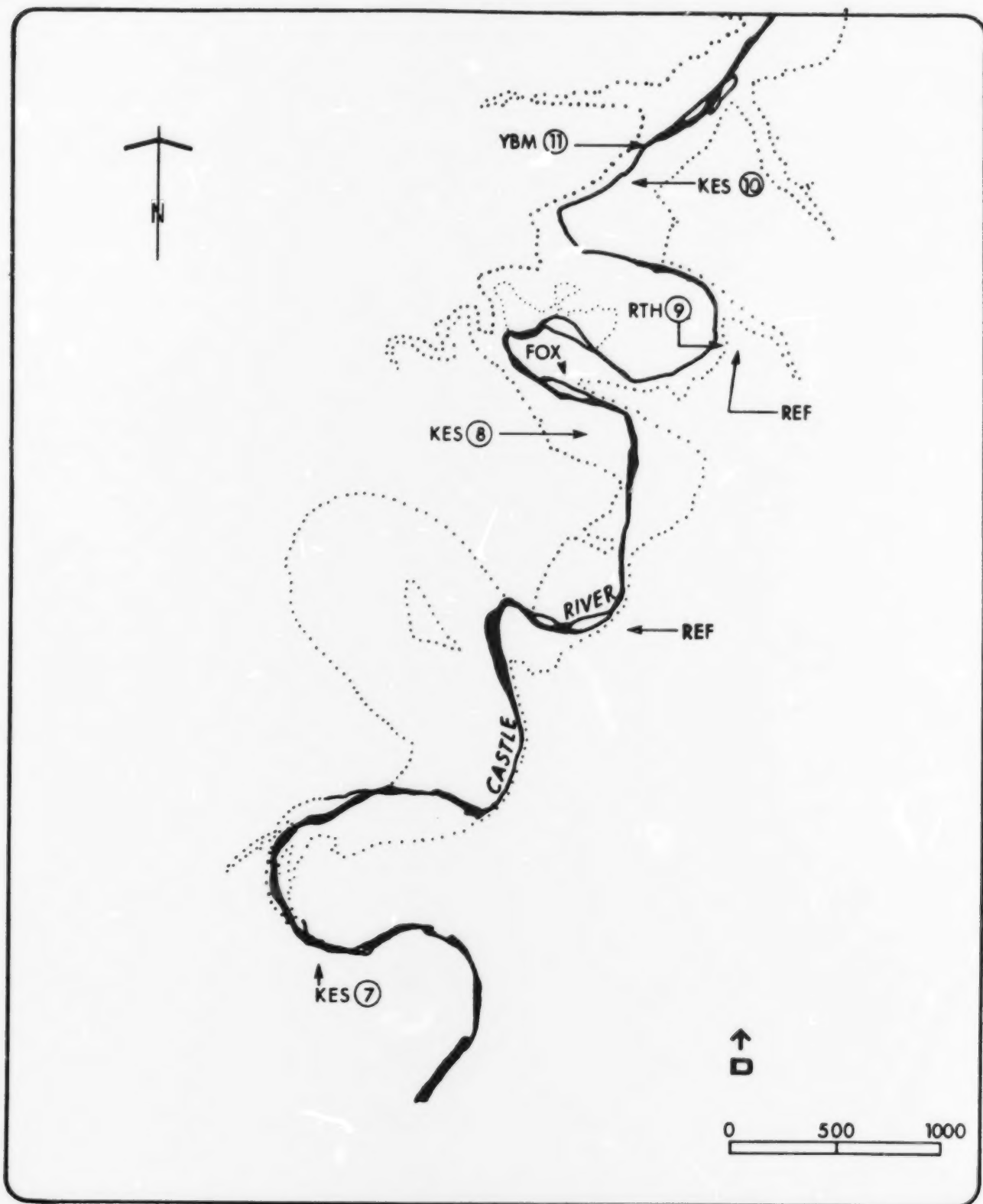


Figure 3E Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk

KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

⑫ Observation Number

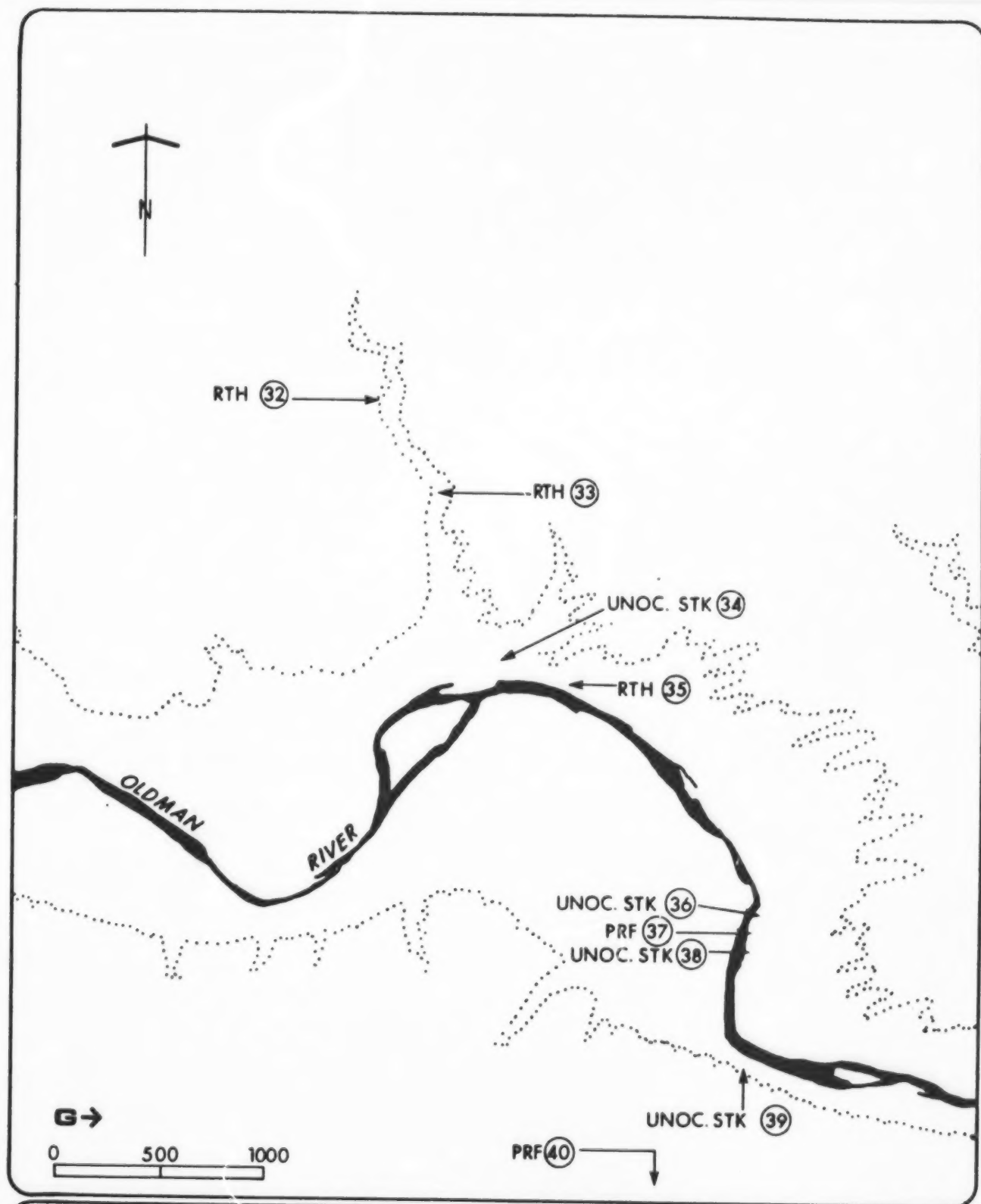


Figure 3F Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk

KES - Kestrel
 UNOC. STK - Unoccupied Stick
 Nest

⑫ Observation Number

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

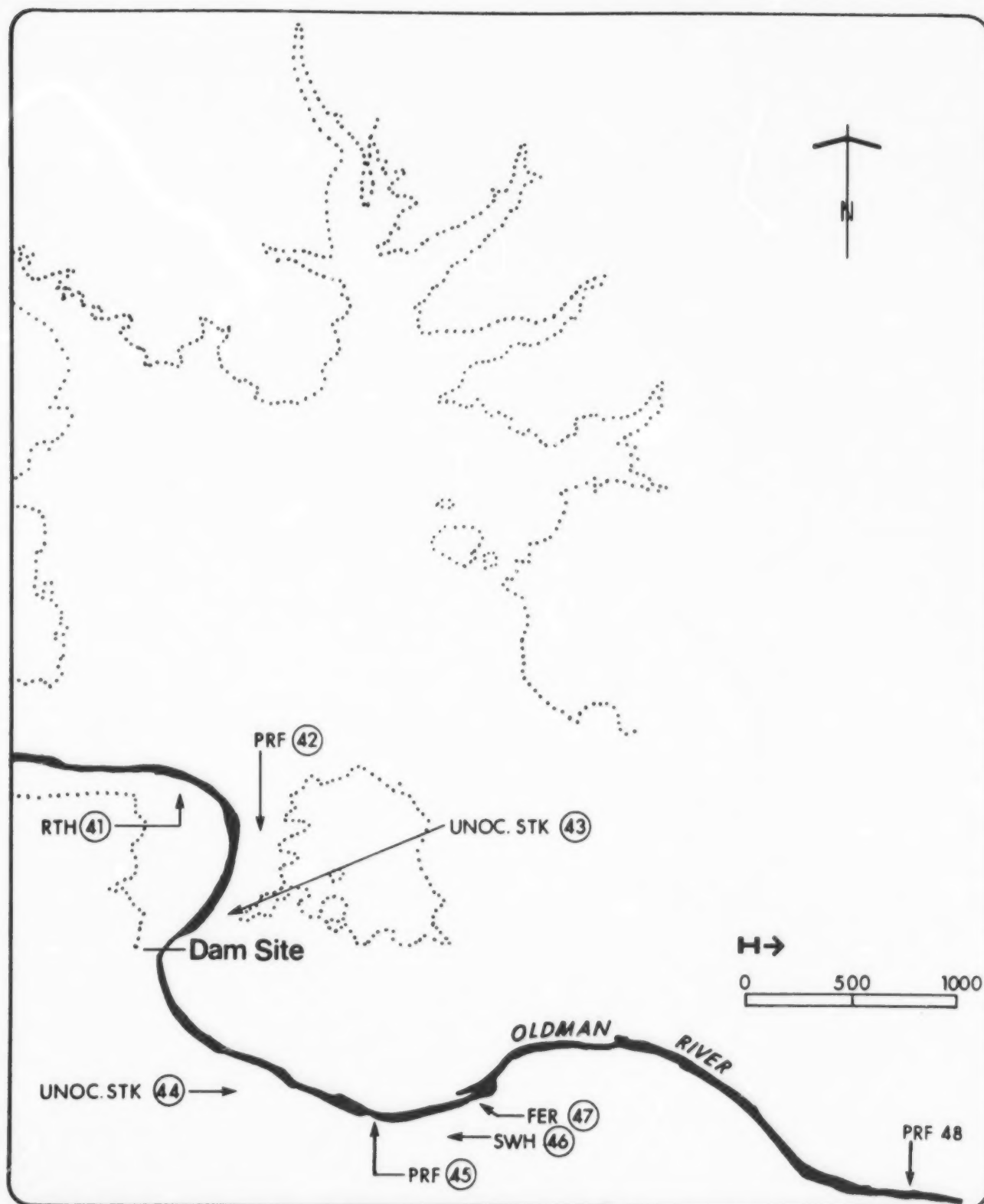


Figure 3G Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk

KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

⑫ Observation Number

MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

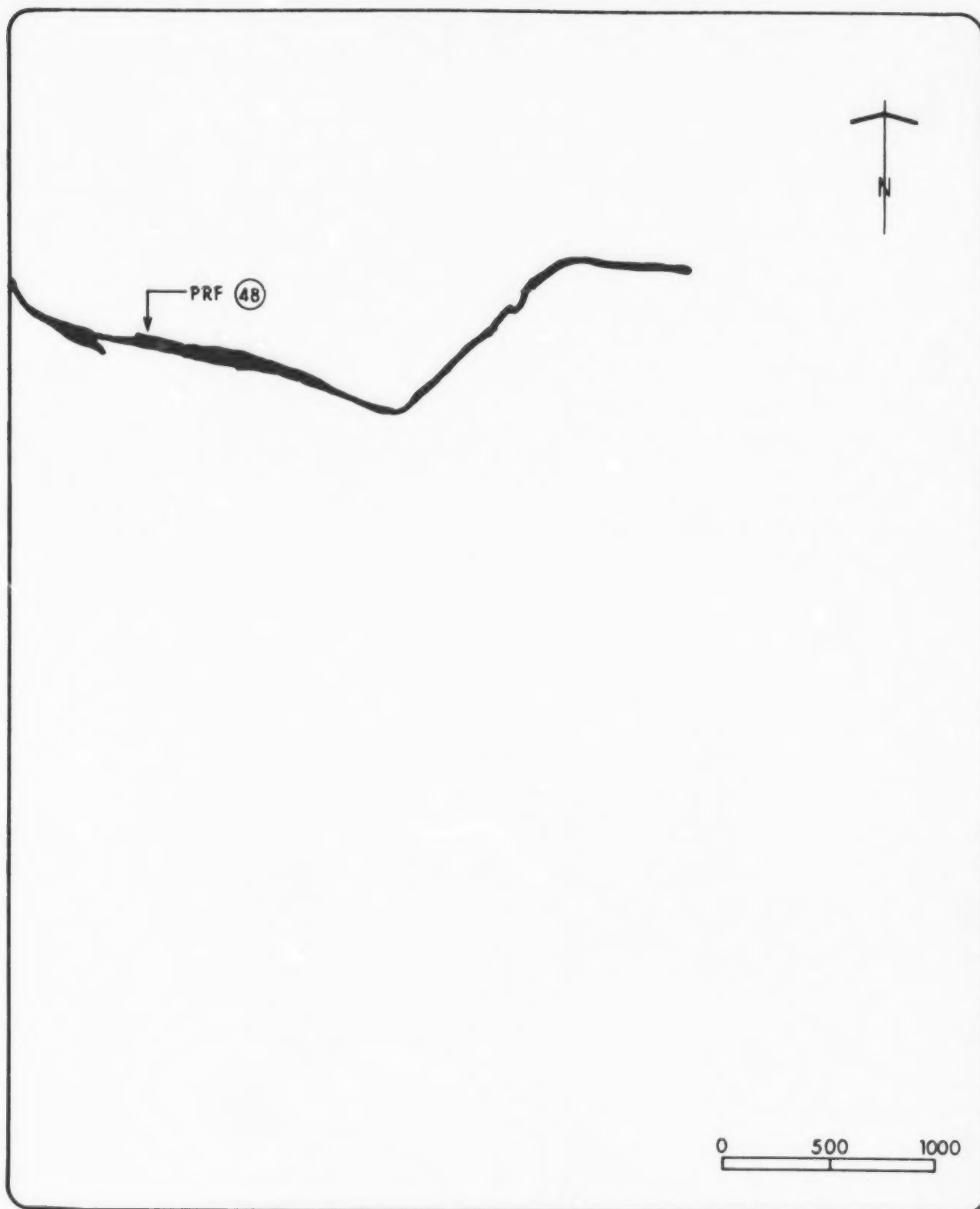


Figure 3H Locations Of Raptor Nests And Mammal Dens In The Oldman River Dam Study Area

RAPTORS

PRF - Prairie Falcon
 FER - Ferruginous Hawk
 RTH - Red-Tailed Hawk
 SWH - Swainson's Hawk

KES - Kestrel
 UNOC. STK - Unoccupied Stick Nest

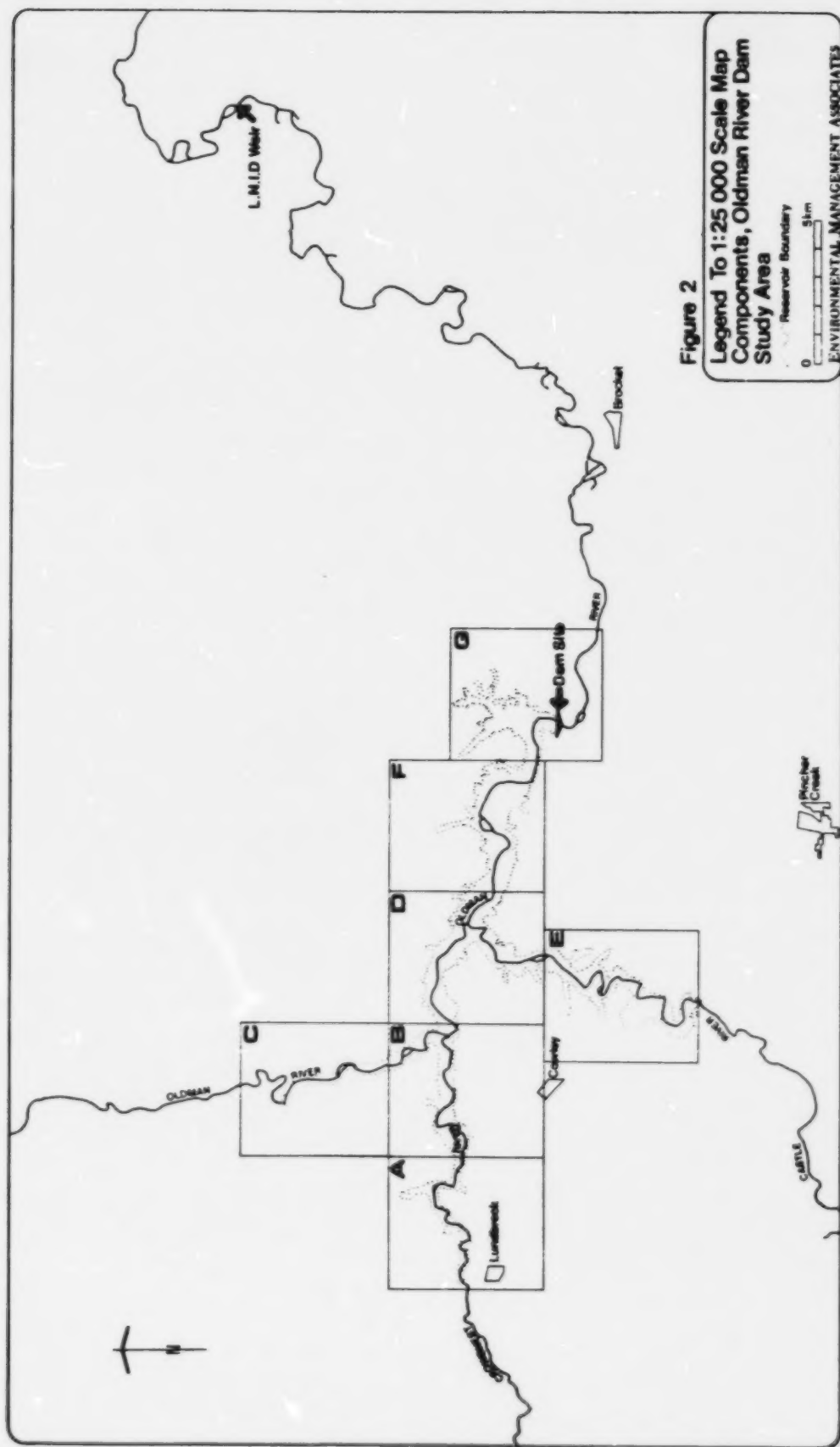
MAMMALS

YBM - Yellow-Bellied Marmot
 REF - Red Fox
 COY - Coyote
 BAD - Badger

⑫ Observation Number

APPENDIX IV

DEER OBSERVATIONS BY SALIX BIOLOGISTS JULY 12 - SEPTEMBER 3, 1985



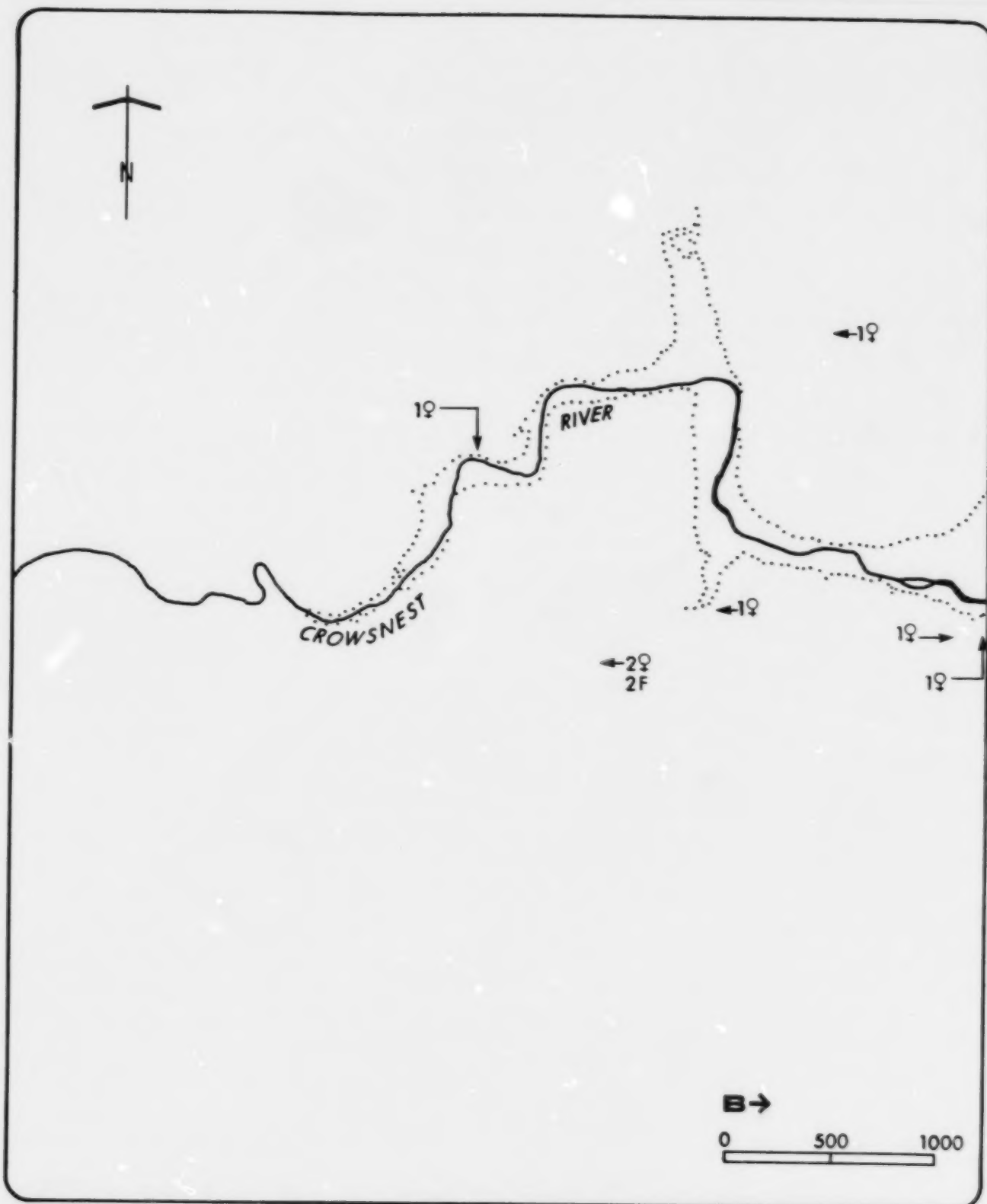


Figure 4A Deer Observations By Salix Biologists
July 12 - September 3, 1985

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

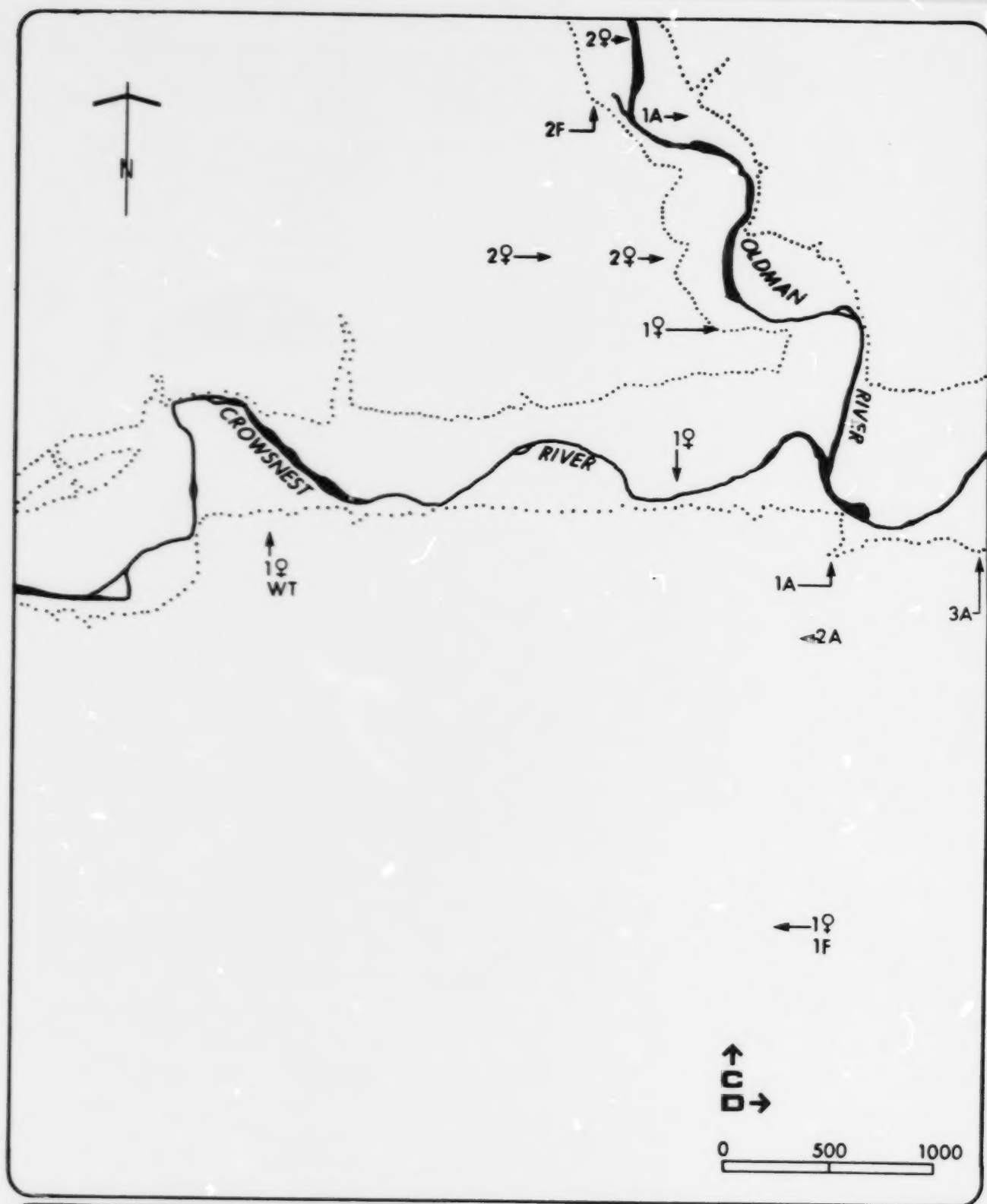


Figure 4B Deer Observations By Salix Biologists
July 12 - September 3, 1985

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

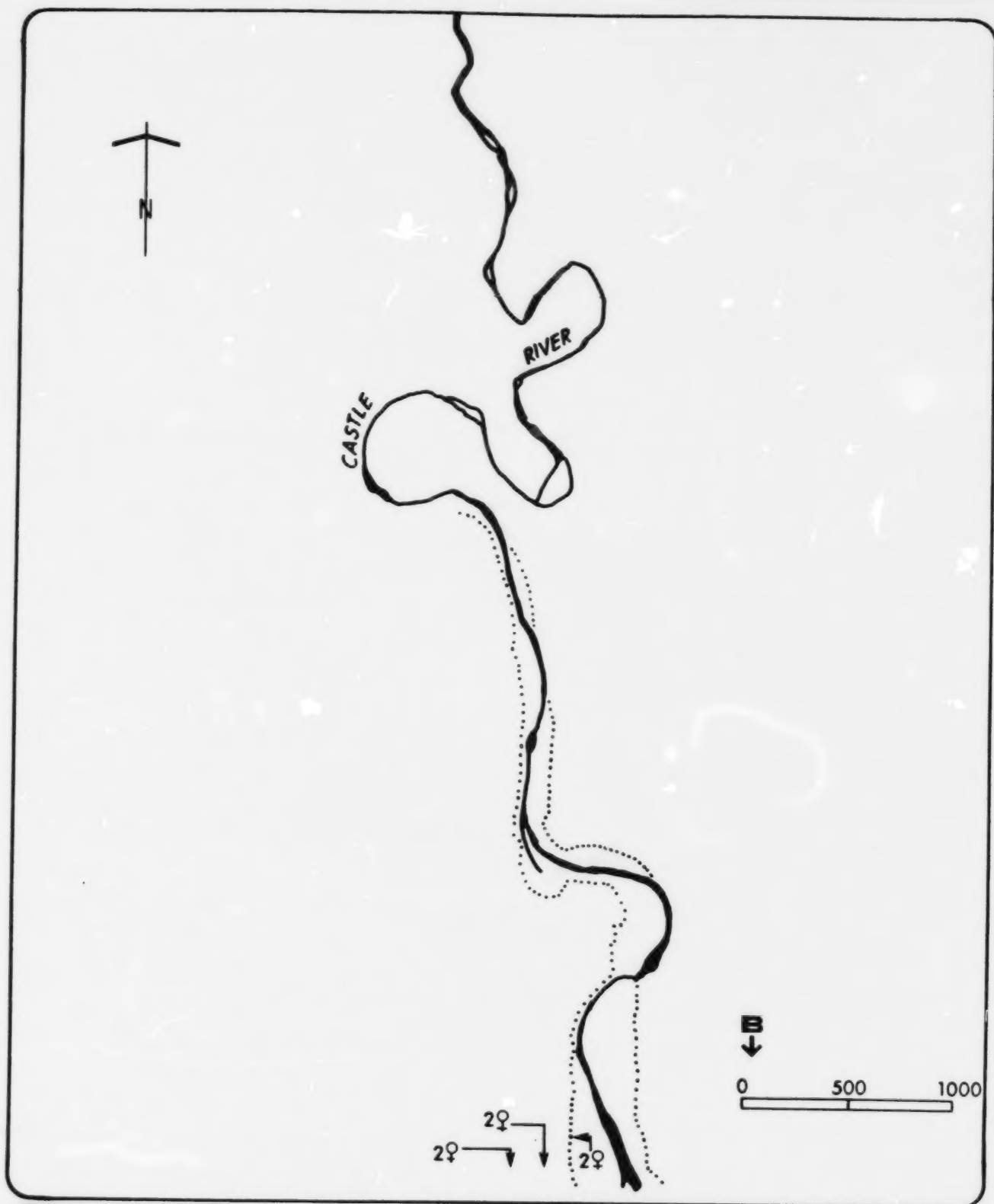


**Figure 4C Deer Observations By Salix Biologists
July 12 - September 3, 1985**

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

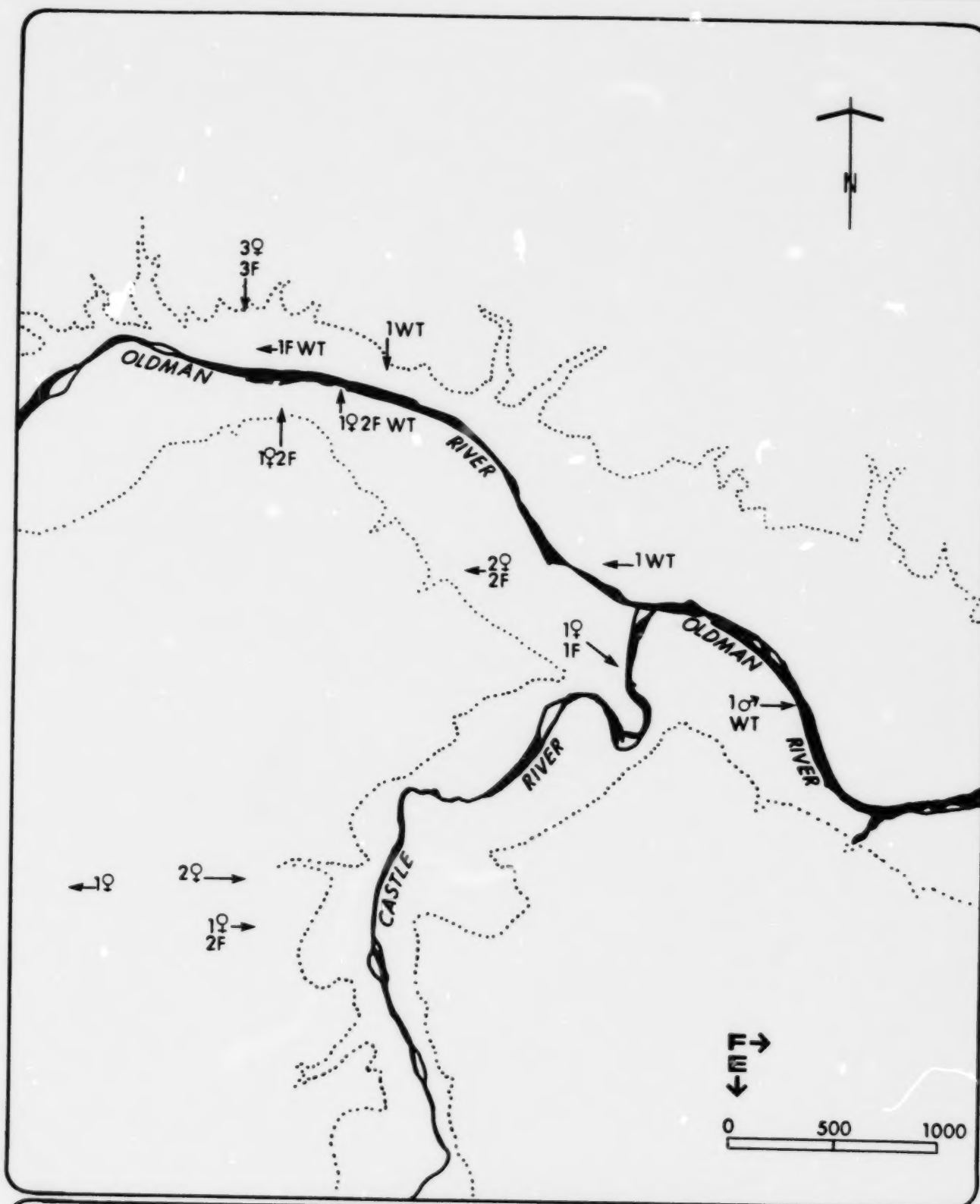


**Figure 4D Deer Observations By Salix Biologists
July 12 - September 3, 1985**

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

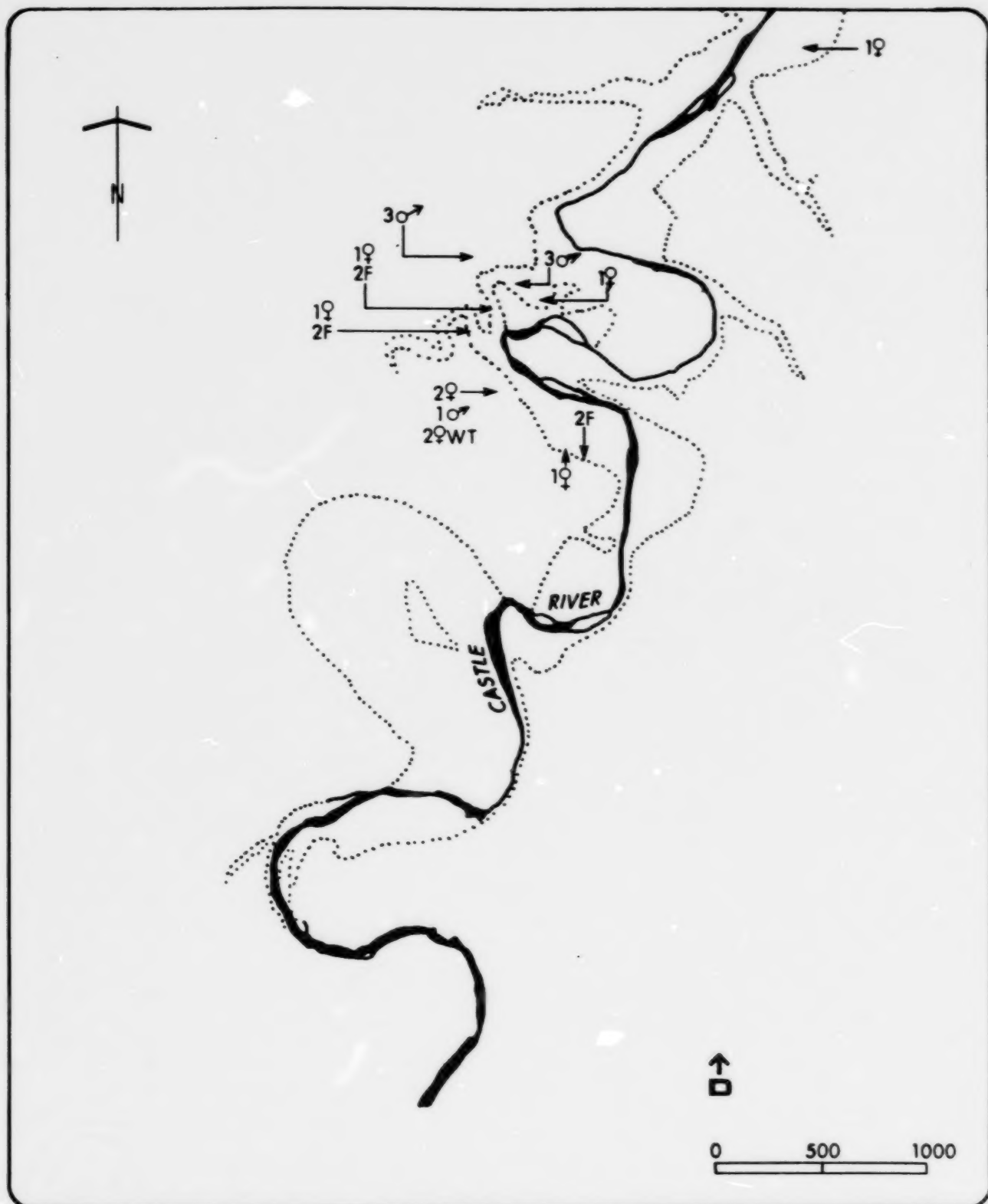


**Figure 4E Deer Observations By Salix Biologists
July 12 - September 3, 1985**

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

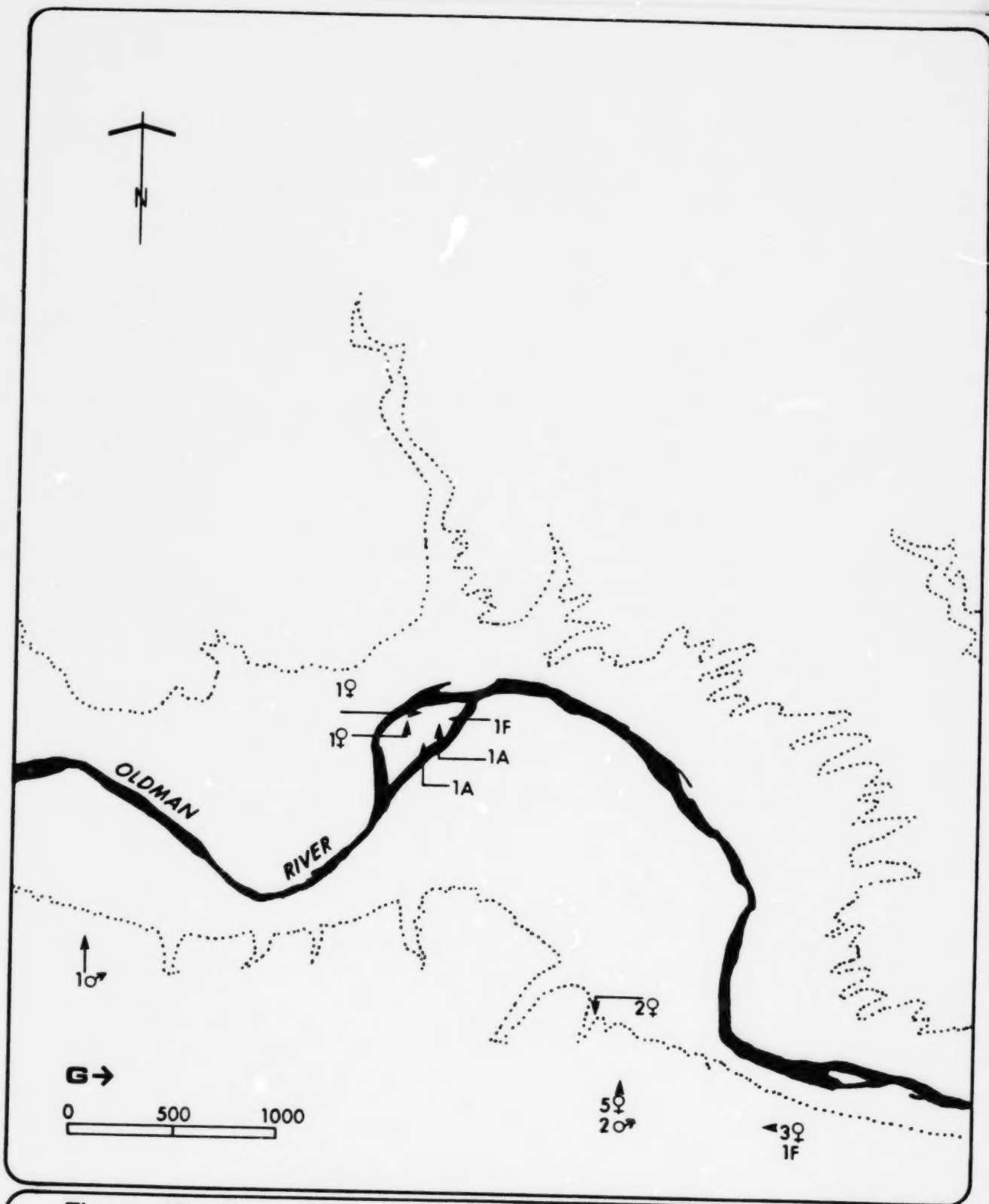


**Figure 4F Deer Observations By Salix Biologists
July 12 - September 3, 1985**

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

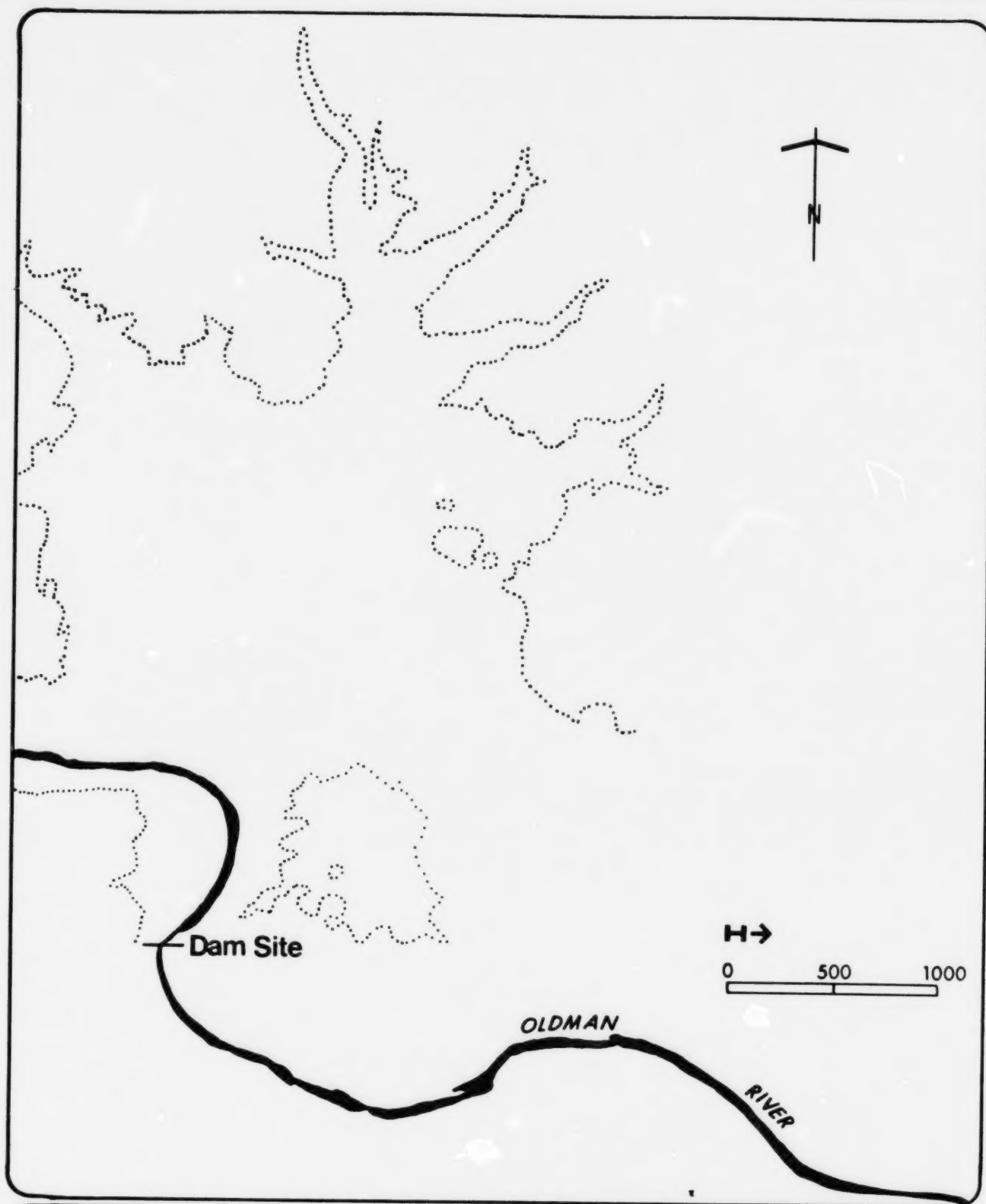


**Figure 4G Deer Observations By Salix Biologists
July 12 - September 3, 1985**

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

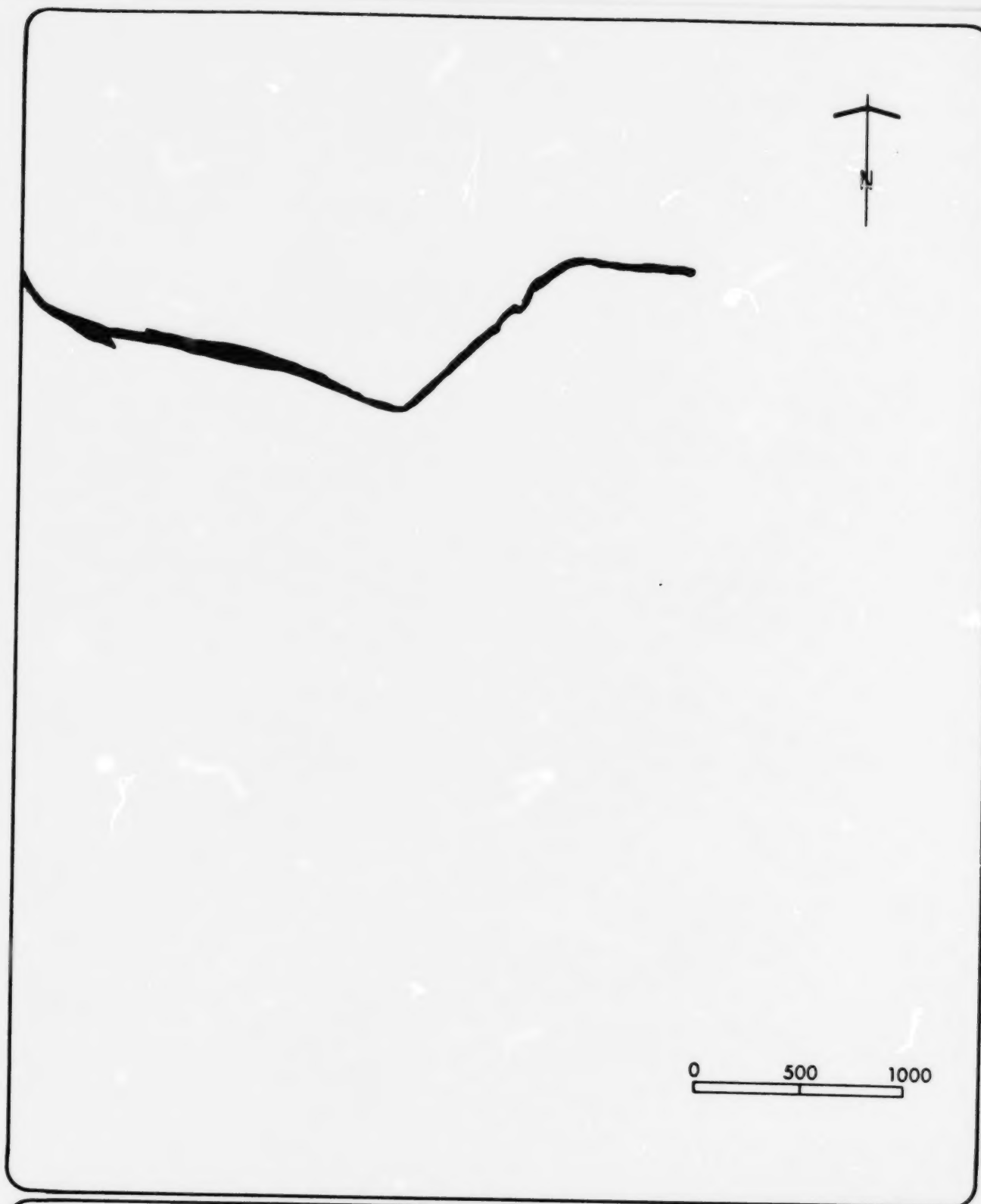


**Figure 4H Deer Observations By Salix Biologists
July 12 - September 3, 1985**

1♀ - 1 Female Mule Deer

2♂ - 2 Male Mule Deer

1F - 1 Fawn Mule Deer

1A - 1 Adult Mule Deer, Sex Unknown

2♀WT - 2 Female White-Tailed Deer

1WT - 1 Adult White-Tailed Deer, Sex Unknown

APPENDIX V

SPECIES OBSERVED WITHIN THE OLDMAN RIVER STUDY AREA, 1985 AND/OR MENTIONED IN THIS TEXT

Common Name	Scientific Name
MAMMALS	
White-tailed Jack Rabbit	<u>Lepus townsendii</u>
Yellow-bellied Marmot	<u>Marmota flaviventris</u>
Beaver	<u>Castor canadensis</u>
Coyote	<u>Canis latrans</u>
Red Fox	<u>Vulpes vulpes</u>
Black Bear (tracks)	<u>Ursus americanus</u>
Mink	<u>Mustela vison</u>
Mule Deer	<u>Odocoileus hemionus</u>
White-tailed Deer	<u>Odocoileus virginianus</u>
Ermine	<u>Mustela erminea</u>
Least Weasel	<u>Mustela nivalis</u>
Long-tailed Weasel ¹	<u>Mustela frenata</u>
Badger ¹	<u>Taxidea taxus</u>
BIRDS	
Double-crested Cormorant	<u>Phalacrocorax auritus</u>
Great Blue Heron	<u>Ardea herodias</u>
Canada Goose	<u>Branta canadensis</u>
Mallard	<u>Anas platyrhynchos</u>
Green-winged Teal	<u>Anas crecca</u>
American Wigeon	<u>Anas americana</u>
Northern Pintail	<u>Anas acuta</u>
Blue-winged Teal	<u>Anas discors</u>
Canvasback	<u>Aythya valisineria</u>
Barrow's Goldeneye	<u>Bucephala islandica</u>
Common Merganser	<u>Mergus merganser</u>
Red-breasted Merganser	<u>Mergus serrator</u>
Hooded Merganser	<u>Lophodytes cucullatus</u>
Killdeer	<u>Charadrius vociferus</u>
Long-billed Curlew	<u>Numenius americanus</u>
Greater Yellowlegs	<u>Tringa melanoleuca</u>
Spotted Sandpiper	<u>Actitis macularia</u>
Long-billed Dowitcher	<u>Limnodromus scolopaceus</u>
Common Snipe	<u>Gallinago gallinago</u>
Least Sandpiper	<u>Calidris minutilla</u>
Ring-billed Gull	<u>Larus delawarensis</u>
Herring Gull	<u>Larus argentatus</u>
California Gull	<u>Larus californicus</u>
Golden Eagle	<u>Aquila chrysaetos</u>
Bald Eagle	<u>Haliaeetus leucocephalus</u>

continued . . .

Appendix V (continued)

Common Name	Scientific Name
Birds (continued)	
Northern Harrier	<u>Circus cyaneus</u>
Cooper's Hawk	<u>Accipiter cooperii</u>
Red-tailed Hawk	<u>Buteo jamaicensis</u>
Swainson's Hawk	<u>Buteo swainsoni</u>
Ferruginous Hawk	<u>Buteo regalis</u>
Osprey	<u>Pandion haliaetus</u>
American Kestrel	<u>Falco sparverius</u>
Merlin	<u>Falco columbarius</u>
Peregrine Falcon	<u>Falco peregrinus</u>
Prairie Falcon	<u>Falco mexicanus</u>
Gray Partridge	<u>Perdix perdix</u>
Rock Dove	<u>Columba livia</u>
Mourning Dove	<u>Zenaida macroura</u>
Short-eared Owl	<u>Asio flammeus</u>
Great Horned Owl	<u>Bubo virginianus</u>
Common Nighthawk	<u>Chordeiles minor</u>
Belted Kingfisher	<u>Ceryle alcyon</u>
Northern Flicker	<u>Colaptes auratus</u>
Yellow-bellied Sapsucker	<u>Sphyrapicus varius</u>
Hairy Woodpecker	<u>Picoides villosus</u>
Eastern Kingbird	<u>Tyrannus tyrannus</u>
Western Kingbird	<u>Tyrannus verticalis</u>
Western Wood-pewee	<u>Contopus sordidulus</u>
Say's Phoebe	<u>Sayornis saya</u>
Least Flycatcher	<u>Empidonax minimus</u>
Horned Lark	<u>Eremophila alpestris</u>
Tree Swallow	<u>Tachycineta bicolor</u>
Bank Swallow	<u>Riparia riparia</u>
Northern Rough-winged Swallow	<u>Stelgidopteryx serripennis</u>
Cliff Swallow	<u>Hirundo pyrrhonota</u>
Barn Swallow	<u>Hirundo rustica</u>
Clark's Nutcracker	<u>Nucifraga columbiana</u>
Black-billed Magpie	<u>Pica pica</u>
American Crow	<u>Corvus brachyrhynchos</u>
Common Raven	<u>Corvus corax</u>
Black-capped Chickadee	<u>Parus atricapillus</u>
Red-breasted Nuthatch	<u>Sitta canadensis</u>
House Wren	<u>Troglodytes aedon</u>
Rock Wren	<u>Salpinctes obsoletus</u>
Ruby-crowned Kinglet	<u>Regulus calendula</u>
Veery	<u>Catharus fuscescens</u>
American Robin	<u>Turdus migratorius</u>
Gray Catbird	<u>Dumetella carolinensis</u>

continued . . .

Appendix V (concluded)

Common Name	Scientific Name
Birds (continued)	
Brown Thrasher	<u>Toxostoma rutam</u>
Cedar Waxwing	<u>Bombycilla cedrorum</u>
European Starling	<u>Sturnus vulgaris</u>
Warbling Vireo	<u>Vireo gilvus</u>
Yellow Warbler	<u>Dendroica petechia</u>
Northern Waterthrush	<u>Seiurus noveboracensis</u>
Rufous-sided Towhee	<u>Pipilo erythrophthalmus</u>
Vesper Sparrow	<u>Poocetes gramineus</u>
Savannah Sparrow	<u>Passerculus sandwichensis</u>
Song Sparrow	<u>Melospiza melodia</u>
Chipping Sparrow	<u>Spizella passerina</u>
Clay-colored Sparrow	<u>Spizella pallida</u>
White-crowned Sparrow	<u>Zonotrichia leucophrys</u>
Western Meadowlark	<u>Sturnella neglecta</u>
Red-winged Blackbird	<u>Agelaius phoeniceus</u>
Brewer's Blackbird	<u>Euphagus cyanocephalus</u>
Brown-headed Cowbird	<u>Molothrus ater</u>
Northern Oriole	<u>Icterus galbula</u>
Western Tanager	<u>Piranga ludoviciana</u>
House Sparrow	<u>Passer domesticus</u>
Pine Siskin	<u>Carduelis pinus</u>
American Goldfinch	<u>Carduelis tristis</u>
White-winged Crossbill	<u>Loxia leucoptera</u>
HERPETOFAUNA	
Western Painted Turtle ¹	<u>Chrysemys picta bellii</u>
Northern Leopard Frog ¹	<u>Rana pipiens</u>

¹ Not observed during this study.

APPENDIX VI

SPECIES OBSERVED DURING EACH OF THE TWO FLOAT TRIPS ALONG THE
CROWNEST, CASTLE AND OLDMAN RIVERS, SUMMER, 1985

Species	Float Survey I Jun 6-8			Float Survey II July 16-19		
	Crowsnest River	Castle River	Oldman River	Crowsnest River	Castle River	Oldman River
MAMMALS						
Yellow-bellied Marmot		X			X	
Red Fox						X
Coyote						
White-tailed Deer						X
Mule Deer		X	X	X		X
BIRDS						
Great Blue Heron	X		X	X		X
Canada Goose		X	X			X
Mallard	X	X	X	X		X
Green-winged Teal	X		X	X		
American Wigeon	X		X			
Northern Pintail			X			
Blue-winged Teal	X		X			
Canvasback		X				
Barrow's Goldeneye		X				
Common Merganser	X	X	X	X		X
Hooded Merganser				X		
Cooper's Hawk	X					
Red-tailed Hawk	X	X	X	X		X
Swainson's Hawk	X	X	X			X
Ferruginous Hawk			X			X
Northern Harrier	X		X			X
Osprey						X
Prairie Falcon		X	X		X	X
American Kestrel	X	X	X	X		X
Gray Partridge			X			
Greater Yellowlegs				X		X
Killdeer	X	X	X	X		X
Common Snipe	X					X
Spotted Sandpiper	X	X	X	X		X
Long-billed Dowitcher						X
Herring Gull						X
California Gull	X		X	X		X
Ring-billed Gull						X

continued . . .

Appendix VI (continued)

Species	Float Survey I Jun 6-8			Float Survey II July 16-19		
	Crowsnest River	Castle River	Oldman River	Crowsnest River	Castle River	Oldman River
Birds (continued)						
Rock Dove	X	X	X	X	X	X
Mourning Dove	X	X	X	X	X	X
Great Horned Owl			X	X		
Belted Kingfisher	X	X	X	X	X	X
Northern Flicker	X	X	X	X	X	X
Yellow-bellied Sapsucker			X			
Hairy Woodpecker			X			X
Eastern Kingbird	X	X	X	X		X
Say's Phoebe		X			X	
Least Flycatcher	X		X	X		X
Western Wood-pewee	X		X	X		X
Tree Swallow	X	X	X	X	X	X
Bank Swallow	X	X	X	X	X	X
Northern Rough-winged Swallow	X	X	X	X	X	X
Barn Swallow	X	X	X	X	X	X
Cliff Swallow	X	X	X	X	X	X
Black-billed Magpie	X	X	X	X	X	X
Common Raven		X	X		X	X
American Crow	X	X	X	X	X	X
House Wren	X	X	X	X	X	X
Rock Wren						X
Gray Catbird	X		X	X		X
Brown Thrasher	X			X		X
American Robin	X	X	X	X	X	X
Veery			X			
Cedar Waxwing	X		X	X		X
European Starling	X	X	X	X	X	X
Warbling Vireo	X		X	X	X	X
Yellow Warbler	X		X	X		X
Northern Waterthrush			X			
Western Tanager						X
Rufous-sided Towhee			X			
Clay-colored Sparrow	X		X	X		X
Vesper Sparrow			X			X
Savannah Sparrow	X					X
Song Sparrow			X			
White-crowned Sparrow				X		X
Red-winged Blackbird	X	X	X		X	X
Brewer's Blackbird			X			

continued . . .

Appendix VI (concluded)

Species	Float Survey I Jun 6-8			Float Survey II July 16-19		
	Crowsnest River	Castle River	Oldman River	Crowsnest River	Castle River	Oldman River
Birds (continued)						
Brown-headed Cowbird	X		X	X		X
Northern Oriole	X		X	X		X
Pine Siskin			X			X
American Goldfinch	X		X	X		X
House Sparrow	X	X	X	X	X	X

APPENDIX VII

NUMBER OF ADULT WATERFOWL OBSERVED WITHIN THE PROPOSED RESERVOIR AREA,
IN BUFFER ZONES AND IN THE AREA BETWEEN THE PROPOSED DAM SITE AND THE
L.N.I.D. WEIR DURING THE AERIAL SURVEY AND TWO FLOAT TRIP SURVEYS, SUMMER, 1985

Species	Location	Helicopter Survey Jun 5	Float Survey I Jun 6-8	Float Survey II Jul 16,18-19	TOTAL
CANADA GOOSE	Crowsnest River	0			
	Castle River	4	2		6
	Oldman River (within reservoir)	9	4		13
	Oldman River (dam to L.N.I.D.)	5	11	139	155
	Buffer Zones	2			2
	TOTAL	20	17	139	176
MALLARD	Crowsnest River	4	19	4	27
	Castle River	6	2		8
	Oldman River (within reservoir)	12	11	1	24
	Oldman River (dam to L.N.I.D.)	69	56	3	128
	Buffer Zones		2		2
	TOTAL	91	90	8	189
GREEN-WINGED TEAL	Crowsnest River		2	1	3
	Castle River				
	Oldman River (within reservoir)				
	Oldman River (dam to L.N.I.D.)		2		2
	Buffer Zones				
	TOTAL		4	1	5
AMERICAN WIGEON	Crowsnest River	2	4		6
	Castle River				
	Oldman River (within reservoir)		2		2
	Oldman River (dam to L.N.I.D.)	9	3		12
	Buffer Zones				
	TOTAL	11	9		20

continued . . .

Appendix VII (continued)

Species	Location	Helicopter Survey Jun 5	Float Survey I Jun 6-8	Float Survey II Jul 16, 18-19	TOTAL
NORTHERN PINTAIL	Crowsnest River		1		1
	Castle River	1			1
	Oldman River				
	(within reservoir)	1			1
	Oldman River				
	(dam to L.N.I.D.)	2			2
	Buffer Zones				
TOTAL		4	1		5
BLUE-WINGED TEAL	Crowsnest River	1	2		3
	Castle River				
	Oldman River				
	(within reservoir)				
	Oldman River				
	(dam to L.N.I.D.)		2		2
	Buffer Zones				
TOTAL		1	4		5
CANVASBACK	Crowsnest River				
	Castle River		1		1
	Oldman River				
	(within reservoir)				
	Oldman River				
	(dam to L.N.I.D.)				
	Buffer Zones				
TOTAL			1		1
BARROW'S GOLDENEYE	Crowsnest River				
	Castle River		1		1
	Oldman River				
	(within reservoir)				
	Oldman River				
	(dam to L.N.I.D.)				
	Buffer Zones				
TOTAL			1		1

continued . . .

Appendix VII (concluded)

Species	Location	Helicopter Survey Jun 5	Float Survey I Jun 6-8	Float Survey II Jul 16,18-19	TOTAL
COMMON MERGANSER	Crowsnest River		10	1	11
	Castle River		4	2	6
	Oldman River (within reservoir)	21	27	2	50
	Oldman River (dam to L.N.I.D.)	42	48	6	96
	Buffer Zones				
	TOTAL	63	89	11	163
RED-BREASTED MERGANSER	Crowsnest River				
	Castle River	1			1
	Oldman River (within reservoir)				
	Oldman River (dam to L.N.I.D.)				
	Buffer Zones				
	TOTAL	1			1
HOODED MERGANSER	Crowsnest River			1	1
	Castle River				
	Oldman River (within reservoir)				
	Oldman River (dam to LNID)				
	Buffer Zones				
	TOTAL			1	1

APPENDIX VIII
RAPTOR OBSERVATIONS AND HABITAT UTILIZATION WITHIN THE STUDY AREA, SUMMER, 1985

Species	Observation No.	Location			Habitat Type	Sites at or Below FSL	Sites Above FSL
		Crowsnest River	Castle River	Oldman River			
Red-tailed Hawk	1**	X			3		X
	21			X	3	X	
	25			X	3	X	
	30			X	3	X	
	31			X	6	X	
	41			X	6	X	
	32			X	2A	X	
	33			X	2A	X	
	5	X			1A+6	X	
	9		X		1A	X	
	13		X		2B+6	X	
	35			X	2B	X	
	12	16.7%	16.7%	66.6%			
	TOTAL NO.						
Ferruginous Hawk	47***			X	6		X
	17**			X	1A		X
	3	X			2A	X	
	3	33.3%		66.7%			
TOTAL NO.							
Swainson's Hawk	4	X			2A	X	
	23			X	3	X	
	46			X	6	X	
	3	33.3%		66.7%			
TOTAL NO.							

continued . . .

Appendix VIII (concluded)

Species	Observation No.	Location			Habitat Type	Sites at or Below FSL	Sites Above FSL
		Crowsnest River	Castle River	Oldman River			
American Kestrel	2	X			1A	X	
	20			X	1A	X	
	7**		X		3	X	
	8		X		3	X	
	10		X		3	X	
	27			X	3	X	
	28			X	3	X	
	14		X		3	X	
TOTAL NO.	8	12.5%	50%	37.5%	1R	X	
Prairie Falcon	18**				1A		X
	22			X	1A	X	
	40			X	1A		X
	42			X	1A	X	
	45***			X	1A		X
	48***			X	1A		X
	12		X		2B+6		X
	15		X		2B	X	
	37			X	1A+2B	X	
TOTAL NO.	9	22.2%	77.8%				
Unoccupied Stick Nest	19			X	1A	X	
	29			X	1A	X	
	34			X	1A	X	
	43			X	1A	X	
	6	X			3	X	
	26			X	3	X	
	44			X	3	X	
	36			X	1A+2B	X	
	38			X	1A+2B	X	
	24			X	1A+16	X	
	39			X	6	X	
TOTAL	11	9%		91%			

* Locations illustrated in Figure 3, Appendix III.

** Nest Observations within buffer zone.

*** Downstream of dam site.

APPENDIX IX

A DESCRIPTION OF POTENTIAL BUT UNUSED CLIFF NESTING RAPTOR HABITAT WITHIN THE PROPOSED RESERVOIR (BELOW F.S.L.), SUMMER, 1985¹

Location	Description of Habitat and Map No. () ²	Horizontal Length of Habitat (m)
Crownsnest River	(6) good overhangs, stable cliffs, no birds or wash - Jun 6/85	40
	(14) possible habitat with blasting, Jul 18/85	60
	(16) not optimal habitat, soft; could be managed - Jul 18/85	100
	TOTAL	200
Castle River	(54) potential habitat, soft rock, no bedrock - Jul 19/85	250
	(55) low potential, gradual slope, soft, erosion - Jul 19/85	500
	(58) no ledges, some hard rock - Jul 19/85	200
	(60) no ledges, hard rock - Jul 19/85	100
	(63) one possible ledge, marginal habitat - Jul 19/85	150
	(60) excellent habitat, good ledges, some wash 30 to 75 m above water - Jul 19/85	300
	TOTAL	1 500
Oldman River	(10) ledges on north side, too shallow, spot of wash - Jun 7/85	50
	(27) good holes, little wash - Jul 18	80
	(15) 2 good ledges, lots of wash, SE exposure, 20 m above water, Jun 8/85	80
	(38)(19) 1 good ledge, some wash, north exposure, 34-40 m above water - Jun 8, Jul 18/85	200
	TOTAL	410
GRAND TOTAL		2 110

¹ Some of these areas may be used on alternate years by Prairie Falcons.

² Locations in unpublished notes.

APPENDIX X

A DESCRIPTION OF POTENTIAL BUT UNUSED CLIFF NESTING RAPTOR HABITAT ABOVE F.S.L. OF THE PROPOSED RESERVOIR, IN BUFFER ZONES AND IN THE AREA BETWEEN THE PROPOSED DAM SITE AND THE L.N.I.D. WEIR, SUMMER, 1985

Location	Description of Habitat and Location ¹	Horizontal Length of Habitat (m)
Crowsnest River Buffer Zone		none
Castle River Buffer Zone	marginal area on east bank of river; NW exposure	max 100
Upper Oldman River Buffer Zone	includes balance of the cliff-face currently occupied by nesting Prairie Falcons	200
Upper Oldman River (above FSL)	(20) VIDEO - SW exposure, rock - Jul 18	200
Below Dam Site to L.N.I.D.	(37) PHOTO 22 - S exposure, wash, no birds good ledges - Jun 8	100
	(42) PHOTO 28 - S exposure, wash on ledge, rock - Jun 8	
	(2) PHOTO 29 - S exposure, little wash, sandstone - Jun 8/85	200
	(10) PHOTO 30 - S exposure, sandstone - Jun 9	150
TOTAL		1 080

¹ Locations in unpublished notes.